UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL – UFRGS
PROGRAMA DE PÓS-GRADUAÇÃO EM ECOLOGIA

COMPOSIÇÃO, ESTRUTURA E SAZONALIDADE DOS BANDOS MISTOS DE AVES EM UM REMANESCENTE DE FLORESTA PALUDOSA NO SUL DO BRASIL

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Dissertação apresentada ao Programa de Pós-Graduação em Ecologia, Universidade Federal do Rio Grande do Sul, como parte dos requisitos para a obtenção do título de Mestre em Ecologia

Porto Alegre, abril de 2006.

Resumindo o ano de 2005...

“Ando sozinho pelas ruas
Nas esquinas de qualquer lugar
Vejo um menino
Um velho pássaro
Que não se cansa de voar
Ares de uma mulher
Corpo que seduz
Me leva um pouco para lá
Paro e vejo uma luz
Pode ser o sol
E nada poderá mudar”

Duca Leindecker, Cidadão Quem

DEDICATÓRIA

Dedica esta dissertação à minha mãe, Neusa Barcelos, que de tão coruja chega a colocar faixas de parabéns na frente de casa (um tanto embaraçosas, digo).

Também dedico à memória de meu avô, Florindo Barcellos, o único homem que eu queria imitar quando crescesse.

Por final, também dedico à minha corujíssima avó Isabel Barcellos, que sabe como ninguém o significado da palavra “amor”.

AGRADECIMENTOS

Nem em mil vidas eu poderei retribuir à altura o auxílio de todos aqueles que cruzaram o meu caminho na senda do mestrado. Desta forma, esta lista de agradecimento é uma tosca tentativa de mostrar minha gratidão.

A primeira pessoa a quem devo agradecer, e que merece figurar com honra no topo desta lista, é Andreas Kindel, meu orientador, que encampou a idéia de trabalhar com comportamento de aves na floresta paludosa.

A Sandra Hartz, Adriano Melo, Iury Accordi e Pedro Develey, pelas críticas e sugestões ao projeto original.

As seguintes pessoas foram valiosas por sua companhia em campo e pela ajuda na "construção" da "Trans-Faxinal": Clarissa Britz, Ricardo Dobrowolski, Roberson "Boliviano", Ricardo Dalbem, e Anelise Azevedo. Estas corajosas criaturas foram companheiros de desbravamento e de "Camboja" (eles sabem do que estou falando).

A Patrick Colombo, então diretor do Parque de Itapeva, que permitiu a abertura da "Trans" e sempre foi muito prestimoso, em tudo.

A Cláudia Brandt, que cedeu com camaradagem algumas das fotos que ilustram o seminário, e cuja companhia no último (e mais difícil) campo ajudou a segurar a minha onda.

Glauco Schüssler, Mariane Beretta, Igor Pfeiffer Coelho e Iury Accordi tornaram possível a tomada de dados de estrutura de hábitat. Sem eles, esta atividade seria impossível.

Aos amigos e colegas Júlio de Sá, Priscila Miorando, Karina Amaral, Luciane Diehl, Ana Luiza, Josielma e Igor Coelho, que amenizaram a solidão e foram companheiros valiosos na claustrofobia do "Inferno Arbóreo".

A CAPES pela concessão da bolsa, aos funcionários do PPG Ecologia, e a SEMA (DUC-DEFAP) pelas inúmeras autorizações para a entrada no Parque Estadual de Itapeva.

A Leandro Duarte, pelo auxílio na análise estatística.

A Jéssica Schmitz, pela revisão do Inglês.

Aos Guardas-Parque Ariel, Antonio, Andraino, Noé, Jaime e Chico, pela geladeira, pelos churrascos, pela paciência e, sobretudo, pela companhia.

Aos meus familiares e amigos por respeitarem minha ausência, mesmo quando não a compreenderam.

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RESUMO

Analisou-se a composição, estrutura e padrão sazonal de formação dos bandos mistos de aves em um remanescente de floresta paludosa na planície costeira do Rio Grande do Sul, sul do Brasil. Efetuaram-se amostragens mensais de fevereiro de 2005 a janeiro de 2006, com observações ocasionais em 2004 e janeiro de 2005. Pontos de contagem foram utilizados para estimar a abundância relativa das espécies integrantes dos bandos, e transecções foram efetuadas para as observações dos bandos mistos. Quarenta e sete espécies foram registradas como participantes em 92 bandos amostrados. O número de indivíduos foi positivamente correlacionado com o número de espécies dentro dos bandos. O *pool* dos não-passeriformes foi pobremente representado nos bandos, enquanto passeriformes suboscines e oscines foram igualmente representados na riqueza dos bandos. Onívoros e insetívoros foram bem representados, mas os nectarívoros tiveram apenas uma espécie integrante; frugívoros e granívoros foram ausentes nos bandos mistos. Espécies migratórias foram pouco representadas nos bandos, como havia sido verificado para outras áreas de Floresta Atlântica. A regularidade de uma espécie em integrar bandos mistos foi uma função de sua abundância relativa, e as espécies mais conspícuas tenderam a ser os integrantes mais regulares. Detectaram-se quinze co-ocorrências significativas em 153 combinações possíveis (10%), onze delas positivas e quatro negativas. Nenhum tipo estrutural de bandos foi distinguido por meio de análise de agrupamento. Associações positivas e negativas talvez estejam relacionadas a similaridades e dissimilaridades na distribuição vertical de cada par de espécies. Os atributos de freqüência, tamanho e riqueza dos bandos foram os menores encontrados em qualquer outro estudo na Floresta Atlântica. Os bandos formaram-se o ano inteiro no Faxinal, mas a freqüência, o tamanho e a riqueza dos bandos diferiram significativamente entre os meses e entre as estações. Os valores máximos destes três atributos foram encontrados na estação não-reprodutiva, lembrando os padrões encontrados em outros locais da Floresta Atlântica. A combinação de um pequeno grupo de espécies abundantes e bem distribuídas, junto com uma baixa riqueza local talvez torne a estrutura dos bandos mistos no Faxinal menos variável do que em outros locais da Floresta Atlântica.

PALAVRAS-CHAVE: bandos mistos, ecologia comportamental, Floresta Atlântica paludosa, sazonalidade, sociobiologia, riqueza, diversidade.

ABSTRACT

The composition, structure and seasonal pattern of formation of mixed-species bird flocks were analyzed in a swamp forest remnant in the coastal plain of Rio Grande do Sul state, southern Brazil. Field work was carried out monthly from February 2005 to January 2006, plus occasional observations in 2004 and January 2005. Point counts estimated the relative abundance of flocking species, and transects were performed to access data relative to the flocks. Forty seven species were recorded as participants in 92 flocks sampled. The number of individuals was positively correlated with the number of species within the flocks. Non-passerines pool is less represented in the flocks, while suboscines and oscines were equally represented in the flock richness. Omnivores and insectivores were well represented, but nectarivores had only one flocking species while frugivores and granivores were absent in flocks. Migrants had low representation on the composition and structure of flocks, as predicted for lowland Atlantic Forest areas. The regularity of a given species in to integrate flocks was a function of its relative abundance, and the species more conspicuous tended to be the more regular flock joiners. Fifteen significant co-occurrences of 153 possible pairs (10%) were detected, eleven positively and four negatively associated. None structural type of flocks was recognized through cluster analyses. Positive and negative associations were better explained by similarities or dissimilarities on vertical distribution of each species pair. The attributes of frequency, flock size and flock richness were the lowest found in any study on Atlantic Forest. Flocks were formed throughout the year at Faxinal, but frequency, flock size and flock richness differed significantly between months and between seasons. Higher values of these three attributes were found in non-breeding season, reaching the pattern found elsewhere in Atlantic Forest. The combination of a little set of abundant and well distributed species and low richness perhaps makes the flock structure at Faxinal less variable than that of Atlantic Forest elsewhere.

KEY WORDS: Mixed-species flocks, behavioral ecology, swamp Atlantic Forest, seasonal pattern, sociobiology, richness, diversity.

APRESENTAÇÃO

Em 1975, Edward Wilson lançou um dos livros mais polêmicos dos últimos tempos, “Sociobiology: the new synthesis”. Como o mesmo autor enfatizou em edições posteriores (WILSON, 2000), o livro causou celeuma não em razão de sua proposta de unificar a biologia do comportamento com a ecologia de populações, a fim de compreender os detalhes do comportamento social, mas apenas em razão de sua útima parte, lidando sobre seres humanos. Intitulado “Man: from sociobiology to sociology”, este capítulo foi alcunhado de reducionista por seus críticos, ao que Wilson rebateu que não apenas este capítulo, mas o livro como um todo, é caracterizado justamente por sua proposta holística e de síntese. Entretanto, o reducionismo é a ferramenta primária da ciência, e como tal o seu uso não pode ser estritamente evitado. A leitura deste livro motivou em primeira análise a execução da dissertação aqui apresentada, não apenas por sua visão ao mesmo tempo reducionista e holística, mas também porque o tema das associações multiespecíficas é nele pouco explorado. Embora exista um rol crescente de trabalhos sobre o tema, a recorrência deste fenômeno sociobiológico nos ambientes neotropicais contrasta com a relativamente ainda pobre literatura abordando-o.

A escolha do tema bandos mistos também surgiu em razão da freqüência com que o autor desta dissertação encontrava tais agregações em campo. Desta constatação, surgiu o interesse em buscar informação mais detalhada sobre o tema na literatura, priorizando a informação porventura oriunda da Mata Atlântica do Rio Grande do Sul. Não tão surpreendentemente assim, esta busca resultou quase infrutífera. Encontrou-se uma meia dúzia de trabalhos, todos executados por seus autores na Mata Atlântica do Sudeste do Brasil. A constatação final é a de que o sul do país é um terreno inexplorado quanto ao estudo deste e de outros fenômenos sociobiológicos e comportamentais. Nada surpreendente, quando se sabe que a imensa maioria das espécies de aves brasileiras carece de informações básicas sobre sua biologia, morfometria e história natural. Trabalhos sobre assembléias de aves, embora crescentes em número, são escassos, e especialmente a estrutura e processos das assembléias florestais do estado mais meridional do Brasil são virtualmente desconhecidos.

Para o neotrópico, os estudos sobre bandos mistos de aves concentram-se principalmente na América Central (MOYNIHAN, 1962; POWELL, 1979; HUTTO, 1987, 1988, 1994; LATTA e WUNDERLE Jr., 1996; GRAM 1998), Bacia Amazônica (MUNN e TERBORGH, 1979; MUNN, 1985; TERBORGH *et al.*, 1990), Cerrado (ALVES, 1990; ALVES e CAVALCANTI, 1996; RAGUSA-NETTO, 2000; TUBELIS, 2004, TUBELIS *et al.*, 2006) e Floresta Atlântica do sudeste do Brasil (DAVIS, 1946; STOTZ, 1993; ALEIXO, 1997; DEVELEY e PERES, 2000; MALDONADO-COELHO e MARINI 2000, 2003, 2004). Embora o Rio Grande do Sul seja um dos estados brasileiros melhor estudados ornitologicamente (SICK, 1997; BELTON, 1994; BENCKE e KINDEL, 1999; BENCKE, 2001), praticamente não há informação disponível acerca dos bandos mistos na porção mais meridional do Brasil. Embora haja um aumento crescente no conhecimento distribucional da avifauna de Santa Catarina (e.g., BORNSCHEIN e REINERT, 1996; BENCKE e BENCKE, 2000; NAKA et al., 2000; BORNSCHEIN et al., 1997, 2001; AMARAL, 2002; OLMOS, 2002; BARNETT et al., 2004; BORNSCHEIN et al., 2004; CARLOS et al., 2004; MAURÍCIO, 2005; AMORIM e PIACENTINI, 2006), ainda não existe uma revisão e sumarização recente desta informação desde Rosário (1996), a exemplo do que fez Bencke (2001) no Rio Grande do Sul. A situação se repete para o estado do Paraná, embora, a exemplo do Rio Grande do Sul, esta unidade da federação possua um conhecimento razoável acerca da sua riqueza de aves (SCHERER-NETO e STRAUBE, 1995). Os poucos dados sobre bandos mistos na região sul estão dispersos em trabalhos mais abrangentes de avifauna (e.g., BELTON, 1994; BENCKE, 1996a,b; MARTERER, 1996; ALBUQUERQUE e BRÜGGEMANN, 1996; BARNETT *et al.*, 2004), e existem apenas dois trabalhos versando exclusivamente sobre bandos mistos em Santa Catarina (MORAES e KRUL, 1995; GHIZONI-Jr. e AZEVEDO, 2006).

Além do interesse regional, a presente dissertação também pretende contribuir com informação generalizada sobre os mecanismos responsáveis pela estruturação dos bandos mistos, os quais são pouco conhecidos (POWELL, 1979). Mais estudos descritivos são necessários para a compreensão tanto das causas próximas como das causas remotas atuando sobre a formação de bandos mistos de aves (HUTTO 1994). Assim, toda informação adicional é contributiva, no sentido de direcionar para uma teoria abrangente de causa-e-efeito a respeito dos bandos mistos.

As florestas paludosas são dos ambientes menos conhecidos nos domínios do bioma Mata Atlântica (KINDEL 2002). Pouco se sabe sobre a estrutura das assembléias de aves desta fisionomia, e menos ainda sobre as interações desta assembléia. A floresta paludosa do Parque Estadual de Itapeva (PEVA), localmente conhecida como "Mata do Faxinal" (ANEXO 1), foi escolhida como área para efetuar um estudo de caso sobre os bandos mistos no Rio Grande do Sul. O objetivo fundamental deste estudo foi descrever padrões básicos associados aos bandos mistos, tais como composição de espécies integrantes, estrutura e o comportamento sazonal destes atributos. Esta primeira aproximação resultou no artigo ora apresentado, inédito em sua proposta para o sul do Brasil. Ademais, a situação geográfica do PEVA, situado no limite sul de distribuição da Floresta Ombrófila Densa (*sensu* IBGE, 1986), torna a área de extrema valia para uma futura compreensão da influência de fatores biogeográficos como latitude e altitude na dinâmica e evolução de bandos mistos de aves na América do Sul.

O Parque Estadual de Itapeva possui pelo menos 14 espécies ameaçadas de extinção no Rio Grande do Sul (BENCKE *et al.*, 2003), algumas das quais são mencionadas como integrantes freqüentes de bandos mistos de aves, entre elas: o arapaçu-liso *Dendrocincla turdina*, o limpa-folha-coroado *Philydor atricapillus*, a choquinha-cinzenta *Myrmotherula unicolor* e o capitão-de-saíra *Atilla rufus* (DEVELEY e PERES, 2000; BENCKE *et al.*, 2003). A compreensão do grau de dependência destas espécies em relação ao forrageio e evitação de predadores em bandos mistos pode fornecer informação auxiliar ao manejo e conservação das mesmas nos fragmentos de florestas de planície do litoral norte do Rio Grande do Sul.

Desta forma, a presente dissertação reflete seu aspecto de pioneirismo não apenas em sua tentativa de descrever os atributos dos bandos mistos no Rio Grande do Sul, como também por ser o primeiro trabalho descrevendo processos ecológicos das assembléias de aves em uma floresta paludosa na Mata Atlântica.

Questões adicionais como atividade de forrageio e distribuição das espécies integrantes no espaço horizontal (influência da heterogeneidade) foram abordadas em campo, mas não foram incluídas na presente dissertação. Em razão de restrições operacionais para a realização do trabalho de campo, outros estudos como territorialidade, taxa de movimentação e experimentos sobre a importância das espécies-nucleares não foram abordados.

Alguns dos métodos aqui empregados foram os mesmos utilizados em outros trabalhos para responder ou ilustrar as mesmas questões. Na verdade, muitos dos estudos referidos na lista do artigo ora apresentado são “incompletos”, mesmo quando possuem caráter absolutamente descritivo. Certas questões sobre composição e estrutura, abordadas em determinado estudo, não são consideradas em outro. O presente trabalho pretendeu unificar todas as questões elaboradas a respeito da descrição da composição e estrutura dos bandos, bem como acrescentar novas análises, como, por exemplo, a representação das espécies integrantes por “ensembles” (sensu FAUTH *et al.*, 1996) e por clados.

O artigo está estruturado conforme a exigências do periódico “The Condor” (ANEXO 2). A escolha deste periódico resultou de certa tradição do mesmo em publicar estudos acerca do tema ora abordado. (Como exemplo, cita-se a seguinte seqüência de autores: HUTTO 1987, 1988, 1994, LATTA e WUNDERLE 1996, GRAM 1998, KING e RAPPOLE 2000).

A título de ilustração, bem como visando disponibilizar tal informação para que outros possam replicar as análises estatísticas, o ANEXO 3 exibe a informação completa a respeito de cada bando amostrado durante o período de estudo.

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Mixed-species bird flocks in southern Brazil

COMPOSITION, STRUCTURE AND SEASONALITY OF MIXED-SPECIES BIRD FLOCKS IN A SWAMP FOREST OF SOUTHERN BRAZIL

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Abstract. The composition, structure and seasonal pattern of formation of mixed-species bird flocks were analyzed in a swamp forest of coastal Rio Grande do Sul, southern Brazil. Field work was carried out monthly from February 2005 to January 2006. Point counts estimated the relative abundance of 47 flocking species, and transects were performed to access data relative to the 92 flocks sampled. Non-passerines pool was less represented in the flocks, while suboscines and oscines were equally represented in the flock richness. Omnivores and insectivores were well represented, but nectarivores had only one flocking species while frugivores and granivores were absent in flocks. Migrants had relative low representation on flocks. The regularity of a given species in to integrate flocks was a function of its relative abundance, and the species more conspicuous tended to be the more regular flock joiners. Fifteen significant co-occurrences of 153 possible pairs were detected, eleven positively and four negatively associated. None structural type of flocks was recognized through cluster analyses. Positive and negative associations may be related to similarities or dissimilarities on vertical distribution of each species pair. The attributes of frequency, flock size and flock richness were the lowest found on Atlantic Forest. Flocks were formed year round at Faxinal, but higher values of frequency, flock size and flock richness were found in non-breeding season. The combination of a little set of abundant and well distributed species and low richness perhaps makes the flock structure at Faxinal less variable than that of Atlantic Forest elsewhere.

Key words: *Mixed-species flocks*, *behavioral ecology*, *swamp Atlantic Forest*, *seasonal pattern*, *sociobiology*, *richness*, *diversity*.

Composición de especies, estructura y estacionalidad de las bandadas mixtas de aves en un bosque pantanoso en el sur de Brasil.

Resumen. Analisamos la composición, estructura y los patrones estacionales de formación de bandadas mixtas de aves en un bosque pantanoso costero en el sur de Brasil, desde Febrero 2005 hasta Enero 2006. Puntos de conteo estimaran la abundancia relativa de las 47 especies de bandadas, y se utilizaran transectas para las observaciones de las 92 bandadas amostradas. Los no-passerinos fueron poco representados entre las especies participantes, mientras que soboscinos and oscinos fueron igualmente representados en la riqueza de las bandadas. Omnivoros y insectivoros fueron bien representados, pero nectarívoros tuvieron una única especie participante y los frugivoros y granivoros estubiéran fuera de las bandadas. Los migrantes tubiéran baja representación en las bandadas. Las especies mas detectadas en los puntos de conteo tendieron a ser las más regulares em las bandadas. Onze co-ocurriencias positivas y cuatro negativas fueron detectadas. Ninguno tipo estructural de bandadas fué reconocido por promedio de analisis de agrupamiento. Co-ocurriencias pueden relacionarse a similaridades y disimilaridades em la distribucion vertical de los pares de especies. La riqueza de especies, frecuencia y tamaño de las bandadas fueron los más bajos encontrados en la Selva Atlantica. Las bandadas fueron conspicuas durante todo el año, pero valores mas altos de frecuencia, tamaño y riqueza de especies de las bandadas occurieron em la estacion no-reproductiva. La combinación de un pequeña grupo de especies abundantes y bien distribuidas con uma baja riqueza local probablemente

hacen la estructura de las bandadas mixtas en Faxinal poco variables en relación a otras áreas estudiadas en la Selva Atlantica.

INTRODUCTION

Mixed-species flocks are multispecific associations found in taxonomic groups as diversified as birds (Moynihan 1962, Munn 1985, Powell 1985, Stotz 1993, Develey and Peres 2000), primates (Peres 1992, Bshary and Noë 1997, Chapman and Chapman 2000), marine fishes (Robertson et al. 1976), and miscellaneous (e.g., between birds and primates, Ferrari 1990, Passos 1997). A typical trait of these ecological associations is the close moving of individuals pertaining to distinct species, independently of some resource aggregation. So, the motivation for an individual to integrate these associations is the group by itself (Powell 1985). In this aspect, the mixed flocks differ from aggregations, where the individuals are attracted by a resource distributed in patches, as fruits, seeds, or water (Powell 1979, 1985).

Mixed flocks are conspicuous components of forest bird assemblages, both in temperate and tropical regions (Winterbotton 1949, McClure 1967, Morse 1970, Partridge e Ashcroft 1976, Munn 1985, Hutto 1994, Yaukey 1995, Hino 2002), being more stable and complex in the last situation (Munn e Terborgh 1979, Powell 1985, Greenberg 2000). In the Neotropics, these interactions were studied in Central America (Moynihan 1962, Powell 1979, Hutto 1987, 1988, 1994, Latta and Wunderle, 1996, Gram 1998), Patagonia (Vuilleumier 1967, Ippi and Trejo 2003), Amazon Basin (Munn and Terborgh 1979, Munn 1985, Terborgh et al. 1990), Cerrado (Alves 1990, Alves and Cavalcanti 1996, Ragusa-Netto 2000, Tubelis 2004) and southeastern Atlantic Forest. Bird flocks studies in Atlantic Forest focused mainly on structure (Davis 1946, Moraes e Krul 1995, Aleixo 1997, Ghizoni-Jr. and Azevedo 2006), seasonality (Davis 1946, Develey and Peres 2000, Maldonado-Coelho and Marini 2004), effects of fragmentation and successional stage (Maldonado-Coelho and Marini 2000, 2003, 2004), and possible adaptive reasons (Machado and Rodrigues 2000).

In temperate forests of northern hemisphere, bird flocks are basically restricted to the cold season, being absent during reproductive months (Morse 1970, Austin and Smith 1972, Thiollay 1988). On tropical forests, flocks occur during all year, including reproductive season (Munn and Terborgh 1979, Munn 1985, Powell 1985). However, in certain tropical regions as the Atlantic Forest, the flocks tend to be less diversified and frequent at this time (Davis 1946, Develey and Peres 2000). Seasonal variation in flock composition and size was verified in southeastern Brazil, both in lowlands (Develey and Peres 2000) and highlands (Davis 1946, Machado 1999, 2002, Maldonado-Coelho and Marini 2004). Indeed, Develey and Peres (2000) hypothesized the presence of a latitudinal gradient of species richness in flocks in Atlantic Forest, where the number of flocking species would be negatively correlated with the increase in latitude. The scant information on mixed flocks in southern limits of Atlantic Forest biome prevents the investigation of this conjecture.

Some authors had verified the relative impoverishment and lower stability of eastern Brazilian mixed flocks when compared with the Amazonian ones (Stotz 1993, Aleixo 1997, Develey and Peres 2000). The absence of a true nuclear species, as *Thamnomanes* antshrikes (Thamnophilidae) in Amazonia (Munn and Terborgh 1979) would be responsible for the absence of cohesion among Atlantic flocks members, wich lacks the presence of a species fully nuclear as *Thamnomanes* spp. Even in Atlantic Forest areas where *Thamnomanes caesius* occurs, the species do not behave as a typical nuclear species (Stotz 1993, but see Silveira et al. 2005 for a different observation). In its absence, the function of nuclear species is assumed by less specialized birds as the Red-crowned Ant-Tanager (*Habia rubica*) and the Black-goggled Tanager (*Trichothraupis melanopis*) (Develey and Peres 2000, Maldonado-Coelho and Marini 2004), leading to a highly variable and less predictable flock structure (Aleixo 1997).

This paper inspect certain ecological aspects of mixed-species bird flocks in southern Brazil, by means of the study case in a coastal, swamp forest fragment. We describe the following attributes of flocks: (1) richness and composition of flocking species; (2) structure, understood here as flock size (intra-flock diversity), pattern of association between species, and the representation of distinct ensembles and clades inside flocks; (3) flocking regularity of flocking species; (4) seasonal pattern of variation in the preceding aspects; and (5) social role of each flocking species.

METHODS

STUDY AREA

Mixed flocks were studied at Parque Estadual de Itapeva (PEVA), located in northern coastal plain of Rio Grande do Sul state, southern Brazil (29º20'S, 49º45'W). This *c.* 1000-ha protected area has several vegetation types characteristics of "restinga" formations (*sensu* IBGE 1986), including dry and wet grasslands, swamps, sandy vegetation, arboreal restinga and swamp forest (Dobrovolski et al. 2004). The restingas are a very diversified vegetation complex, included in the domains of Atlantic Forest biome (Falkenberg 1999). Detailed descriptions of local flora can be found in Lindeman et al. (1975) and Kindel (2002). Field work was concentrated in a swamp forest remnant, locally known as "Faxinal", whose encompass 115 ha of the PEVA. This forest is, actually, a mosaic of several fitophysiognomies, ranging from formations with high canopy (20-25 m) growing over seldom inundated soils, to low formations (4-6 m high) with extremely dense understory, growing over almost inundated areas. Dominant trees include species pertaining chiefly to the families Moraceae (*Ficus* spp.), Cecropiaceae (*Coussapoa microcarpa*, *Cecropia catarinensis*), Arecaceae (*Syagrus romanzoffiana*), and Myrtaceae (many genera). Ferns, Bromeliaceae, and the palms *Bactris setosa*, *Euterpe edulis* and *Geonoma schottiana* predominate in the understory.

Epiphytes and lianas are abundant, including many species of Bromeliaceae, Orchidaceae, Cactaceae, Piperacae, and Polypodiaceae, among others (Waechter 1986). The local climate is humid subtropical (Cfa) according to Köppen system, with mean annual precipitation of 1452 mm, with well-distributed rains throughout the year (Kindel 2002). Mean annual temperature is 18.9ºC, with the minimum mean 15.1ºC registered in austral winter (July), and maximum mean 23.6ºC in austral summer (February).

At least five globally threatened and near-threatened bird species (BirdLife International 2004) regularly occur in the study area: White-breasted Tapaculo (*Scytalopus indigoticus*), Unicolored Antwren (*Myrmotherula unicolor*), Restinga Tyrannulet (*Phylloscartes kronei*), Black-backed Tanager (*Tangara peruviana*), and Azure-shouldered Tanager (*Thraupis cyanoptera*). Nine additional species are currently categorized as threatened at a regional scale (Bencke et al. 2003). Many of them have on mixed flocks an important component of their life cycle, as could be seen here and in others works (Stotz 1993, Aleixo 1997, Develey and Peres 2000, Bencke et al. 2003).

Besides the anthropogenic impact directly affecting the swamp forest, like harvesting, clearing and hunting, there was in March 2004 a hurricane-like phenomenon, called “Catarina” (an animated view can be found in http://lwf.ncdc.noaa.gov/oa/climate/research/2004/mar/brazilcane.html), wich strongly affected the arboreal structure in many forest portions, by the fall of large trees. Furthermore, in summer 2005, Rio Grande do Sul experienced a strong and unexpected drought period, less severe in northern coastal plain, but sufficient to dry formerly water saturated soils. Although there are documented records of alterations in the behavior of mixed flocks’ memberships after the struck of a typhoon (Seki and Sato 2002), the consequences of these dramatic weather phenomena on Faxinal's bird assemblage are unknown, do to the lack of previous field work there.

FIELD SAMPLING

Mixed-species flock sampling. The flocks were searched for along a *c*. 2.3 km transect, cut on the north to south axis of forest fragment, crossing six distinct physiognomies. This trail was divided in three distinct sectors, all of them surveyed in three day periods: (1) morning, from one hour after the sunrise until three hours latter; (2) middle-of-day, from three hours after sunrise until three hours before down; and (3) evening. The physiognomies will be described in details in a future work dealing with their effect on the patterns of bird assemblage distribution and on mixed flocks. The transect was sampled in three days each month, from February 2005 to January 2006, giving a total of 373 field hours. In each day, one day period was used to inspect one of the three sectors. Sectors and periods were combined in the three field days until a given sector was trailed in all day periods. Additional data on flocking species and individual numbers were gathered in September and October 2004, and January 2005. These last data were used in all but seasonality analysis. We avoided to work on extremely misty, windy or rainy days.

As the same transect was performed three times at month, we recognize that the same flocks may have been recorded more than one time on subsequent days. However, each flock has equal chance of being counted twice or more, so we assume that this possibility not influenced our analysis. Furthermore, flocks of the same area in distinct days may behave as nearly independent units, as their species composition varies even during a period of few minutes (see below).

We recognized a flock in field as a group of two or more distinct species, moving together in the same direction for at least five min, and independently of external resource concentration (as applied by Latta and Wunderle 1986, and Stotz 1993). This procedure was adopted latter in other Atlantic Forest works (Aleixo 1997, Develey and Peres 2000, Maldonado-Coelho and Marini 2000, 2004), thus making our data feasible to comparisons. Once a flock was encountered, it was followed as long as possible. Flocks were followed during five to thirty five min (mean = 10.8 ± 6.5 SD), and many flocks were accompanied only by the minimum interval of five min. Flocks followed for more than 15 min had their number of individuals and their species composition recorded each 15 min-interval (Austin and Smith 1972, Gram 1998), and resultant flocks' data were considered as distinct sample units. The lower follow mean time of flocks, when compared with other studies, was do to the very thick vegetation, either in understory and canopy, as well as to the wet nature of the soil, who prevented to proceed with the faster flocks.

For each flock we recorded: (1) species number, (2) number of individuals per species, and (3) flock duration. For each flocking individual were recorded, when possible: (1) species, (2) relative horizontal position in flock, classified as front, middle, and back; (3) agonistic behavior, inter or intraspecific. Data collected were related on a cassette recorder and latter transcribed to data sheets.

Bird counts. The bird abundance in study area was estimated by point counts with unlimited distance (Blondel et al. 1981). According to Vielliard (2000), this is the count method that work well in tropical forest environments. Fifteen points were surveyed monthly, from February 2005 to January 2006, except for December 2005. Points were established in the same transect of the mixed flocks study, embracing all the length and physiognomies of Faxinal. The standard distance between one point to another was 200 m, in order to guarantee independence (Bibby et al. 1992). Every individual detected by voice or sight during a 15 min period at each point was considered a contact (as defined by Ralph 1981). Counts were conducted from sunrise until three hours later. The relative abundance of a given species was obtained dividing the total number of species contacts by the total number of counts ($N = 160$). This computation gives the so called Index of Punctual Abundance (IPA), applied in others works conducted in Atlantic Forest (Aleixo e Vielliard 1995, Aleixo 2001, Anjos 2001).

CONVENTIONS

Each flocking species was classified according to its flocking regularity (Hutto 1994), obtained dividing the number of flocks where a given species was recorded, by the total number of flocks sampled. This computation resulted in proportions, categorized according Machado (1999) as (1) regular species, occurring in more than 25% of flocks; (2) common species, from 10 to 24.99%; (3) uncommon species, from 3 to 9.99%; and (4) rare species, those recorded in less than 3% of flocks. We adopted these categories in order to better compare our results with works made elsewhere, and to avoid the subjectivity in the determination of the level of flocking participation for each species (Develey 2001).

Quantitative and qualitative data were used to assign each flocking species to previously defined social roles, following the terminology in Greenberg (2000:528). Core species includes all the regular species, and represents the set of more frequent species in flocks. Attendant species are the remainder categories, representing the species commonly or seldom recorded as flock members, whose few records prevented certain analysis. Nuclear species was recognized according the following quantitative criteria (Hutto 1994, after Moyninhan 1962): (1) they are intraspecifically gregarious (mean number of individuals per flock > 3 and, as a consequence, they are conspicuous in colors and/or noisy in vocalization, (2) they are core species, (3) they are usually seen leading the flocks, being followed by other species more than themselves follow others.

Nuclears are thought as playing a role on the flock formation and cohesion. Leading behavior was recognized during food search and gap-cross activities. A leader species was the one that was recorded searching for food in the front of flocks, as well as that was the first to cross gaps in the forest. The remaining species were recognized as followers.

We assigned each species to groups defined as “guilds” in Willis (1979). These groups are arranged according to habitat affinities, diet type, and/or body size (for example, small canopy omnivores, and ground frugivores). However, in accordance with the nomenclature proposed by Fauth et al. (1996), we adopted the term “ensembles”, instead “guilds”, to designate these groups. Willis’ classification was checked for each species, reclassifying them when appropriate according to local data. The niche dimension of vertical strata was one attribute of habitat affinities, and each species was classified according their mean relative height of foraging (height of a foraging bird from the soil divided by the higher height of the canopy in the immediate vicinity of the bird, Walther 2002). Vertical strata were the same in Willis (1979), but defined numerically as: soil (relative height of 0), understory ($> 0 \leq 0.3$), midlevel ($> 0.3 \leq 0.7$) and canopy ($> 0.7 \leq 1$). Insectivores are understood here as birds eating arthropods in general, not only insects. Omnivore category includes species taking nearly equal amounts of arthropods and plant matter (mainly fruits) in their diet. Body size was represented in terms of mass obtained from literature sources (Belton 1994, Reinert et al. 1996, Bugoni et al. 2002), prioritizing data from southern Brazil and with greatest sample size. Taxonomic sequence and Latin nomenclature are according CBRO (2005); English names follow Bencke (2001). Residence statuses in Rio Grande do Sul follow Belton (1994).

STATISTICAL ANALYSES

In order to inspect the association between regularity of a given species in flocks with its relative frequency in point counts, as well as if the flocking regularity of a given species was correlated with the mean flock's size occupied by it, we used simple linear regression. Flocking regularity and IPA data was normalized through logarithmic transformation, as original data deviated from normality (according to D'Agostino-Pearson test, Zar 1996).

We used two-tailed *t*-test to test if the mean flock size and mean species richness of flocks where each of the ten most frequent flocking species were recorded differed from the total mean of the 92 flocks sampled. Original data were linear transformed. Mann-Whitney *U*-test was used for those data where the variances can not be equalized by linear transformation. Chi-square was used to investigate if proportional abundances of distinct dietary groups and residence statuses differed between mixed flocks and point counts.

We analyzed the patterns of memberships associations in two opposite trends: pair of species that significantly occur in flocks where the respective flock mate was present (positive co-occurrence) and pair of species that significantly occur in flocks where the respective flock mate was not present (negative co-occurrences, checkerboard distributions). The independence of co-occurrences between each pair of species was tested with a chi-square test or a *G*-test with Williams correction for that pair combination where cells in the 2 x 2 contingency table had values inferior to five (Fowler and Cohen 1995). Significant co-occurrences (either negative or positive) were expressed by the coefficient of interspecific association (Cole 1949), ranging from +1 (perfectly positive association between two species) from -1 (perfect avoidance) (Hart and Freed 2003).

According to Graves and Gotelli (1993), mixed-species flocks constitute a model system appropriate to test the assembly rules hypothesis, based in checkerboard distributions originated by competitively structured communities (Diamond 1975), because flocks occur in relatively homogeneous forest tracts and because resident species are potentially interactive full time. In addition to chi-square or *G*-test, we applied null models (Gotelli 2000, Gotelli and McCabe 2002) to verify the associations between pairs of species inside the flocks, through the analysis of either positive or negative co-occurrences. Random matrices (5000 simulations) and values of the co-occurrences indices were achieved using EcoSim software (Gotelli and Entsminger 2006). We used the proportional algorithm both in rows (species) and in columns (flocks) as simulation procedure, and *V*-ratio was employed as co-occurrence metric. In a competitively structured community, the observed *V*-ratio should be significantly smaller than expected by chance, usually less than 1.0 (Gotelli and Entsminger 2006).

Cluster analysis was used to recognize structural types of mixed flocks, classified according to presence-absence of species. The farthest-neighbor (Pielou 1984, Valentin 2000) was used as clustering technique, with Euclidian distance utilized as similarity measure. Cluster analysis and significance of groups partition by bootstrap (1000 iterations, $\alpha = 0.1$) was performed using Multiv 2.3.17 statiscal package (Pillar 2004).

One-way ANOVA with Bonferroni correction was employed to test for differences in the mean number of species (richness) and mean number of individuals (flock size) in flocks between months. The data were normalized and variances of blocks equalized by linear transformation. After, months were grouped in two blocks, corresponding to breeding (September to March) and non-breeding seasons (April to August) of southern hemisphere. For effect of this work, we established the initial month of breeding season as September, based on reproductive evidences recorded in field (e.g., breeding plumage, pair formation, territoriality, arrival of migrants) compared to August. Decrease of the same indicia, including the leave of many migrant species, lead us to determine the end of breeding season at March. The nonparametric Mann-Whitney *U*-test was employed to investigate if there were significant differences between the two periods in the mean richness and mean size of flocks.

Other statistical tests are indicated between parenthesis, after their respective results, including transformation method used. Means are given ± SE. The statistical package BioEstat 3.0 (Ayres et al. 2003) was employed and significance level of α = 0.05 was accepted in all analyses unless stated otherwise.

RESULTS

FLOCK COMPOSITION AND STRUCTURE

Forty seven flocking species in a total of 92 flocks were registered during the study (TABLE 1). This richness of memberships represents 43% of bird species found at Faxinal by means of quantitative and qualitative surveys ($N = 109$, excluding raptors and swallows, Barcellos, pers. obs.). Flocks had a mean species number of 4.2 ± 0.2 (range = 2-13 species) and a mean individuals number of 6.8 ± 0.4 (range = 2-19). Mean biomass of flocks was of 98.4 ± 7.2 g (range = 15.8-628.5, $n = 87$). The number of individuals (flock size) was positively correlated with the number of species within the flocks ($r_s = 0.89$, n = 92, $P < 0.001$, Spearman correlation).

Passerine birds composed the bulk of flocking species, in a ratio of 1 non-passerine for 10.75 passerines (coefficient of 0.09, calculated according to Fowler and Cohen 1995). Only four non-passerines were recorded in flocks: one cuculid (Squirrel Cuckoo [*Piaya cayana*]), and three woodpeckers (Ochre-collared Piculet [*Picumnus temminckii*], White-spotted Woodpecker [*Veniliornis spilogaster*] and Blond-crested

Woodpecker [*Celeus flavescens*]). Among them, the Ochre-collared Piculet was the unique common participant, occurring in at least 16% of flocks recorded (TABLE 1). Suboscines and oscines passerines had almost equal representation in flock composition, with 20 and 23 species each, respectively (ratio of 1:1.15, or a coefficient of 0.87). This composition assimilates the ratio found in the bird assemblage of Faxinal as a whole, where non-passerines (excluding raptors) are outnumbered by passerines (ratio of 1:2.6, coefficient of 0.38) and suboscines and oscines (excluding swallows) have almost equal numeric relationship (ratio of 1:1.19, coefficient of 0.84) (Barcellos, pers. obs.). Clearly, the non-passerine pool is few represented in the flock richness ($\chi^2_1 = 7.7$, $P = 0.005$). While 66% of oscines and 47% of suboscines species of Faxinal are represented in mixed flocks (pools with $n = 36$ and $n = 43$, respectively), only 13% of the non-passerine species pool ($n = 30$) integrates the flocks.

The classification of joining species by ensembles shows the predominance of omnivores and insectivores (FIGURE 1). Certain ensembles of Faxinal's bird assemblage were not represented in mixed flocks: large canopy frugivores, ground frugivores, edge seedeaters, grassland omnivores, and aquatic omnivores (FIGURE 1). The proportion of flocking/non flocking species was larger in understory birds eating small foliage arthropods (0.9), canopy insectivores (0.8), midlevel insectivores (0.7), and small canopy omnivores (0.7), indicating that these groups have the major number of species prone to integrate the flocks. Understory omnivores, edge omnivores, and trunk and twig insectivores had equal representation of flocking and non-flocking species (0.5). Under-represented ensembles are edge insectivores (0.3), understory birds eating large ground arthropods (0.2), and nectarivores-insectivores (0.1). In suboscines, understory birds eating small foliage arthropods predominated among participant species (20%), while other ensembles was nearly equally represented. In oscines, most flocking species were edge omnivores (35%) and small canopy omnivores (30%).

Aggregating the ensembles by diet type, we found that insectivores had greater relative abundance (summing the relative abundances of all species) in flocks than in point counts, in a greatly significant way ($\chi^2_1 = 58.1$, $P < 0.001$; TABLE 2). On the contrary, the relative abundances of nectarivores in flocks was significantly less than relative abundances derived from point count data ($\chi^2_1 = 10.3$, $P = 0.001$). There are not significant difference between the relative abundances of omnivores in flocks and its relative abundances in point counts ($\chi^2_1 = 2.0$, $P = 0.15$). Frugivores and granivores were absent from flocks. With regard to residence statuses, the relative abundances of migratory birds in flocks was significantly lower than their relative abundances derived from point count data ($\chi^2_1 = 24.5$, $P < 0.001$; TABLE 2).

With regard to regularity, six species were regular participants in swamp forest flocks: Golden-crowned Warbler (*Basileuterus culicivorus*) (54.4), Unicolored Antwren (48.9), Tropical Parula (*Parula pitiayumi*) (38.0), Variable Antshrike (*Thamnophilus caerulescens*) (31.5), Red-crowned Ant-Tanager (30.4) and Restinga Tyrannulet (27.2). Thus, they perform the set of core memberships of Faxinal's flocks. Only four species were classified as having common regularity: Bananaquit (*Coereba flaveola*), Ochre-collared Piculet, Ruby-crowned Tanager (*Tachyphonus coronatus*) and Chestnut-bellied Euphonia (*Euphonia pectoralis*). Eighteen species were uncommon and nineteen were rare, both embracing 78% of birds recorded in flocks. Among the uncommon and rare species are the few migrants recorded as flock participants (Fuscous Flycatcher [*Cnemotriccus fuscatus*] Variegated Flycatcher [*Empidonomus varius*] White-winged Becard [*Pachyramphus polychopterus*] and Red-eyed [Chivi] Vireo [*Vireo olivaceus*]). Regarding to the regular species, the Red-crowned Ant-Tanager was the one with the highest average number of individuals per flock (3.6), followed by the Unicolored Antwren (2.0) (TABLE 1). Most species (87%, $n = 41$) averaged fewer than two individuals per flock, giving a grand mean of only 1.35 individual per species per flock.

The flocking regularity was correlated with the index of relative abundance in a highly significant way ($R^2 = 0.21$, $F = 12.5$, $P < 0.001$). To exemplify, three regular (Golden-crowned Warbler, Tropical Parula and Variable Antshrike) and one common (Bananaquit) species in flocks figures between the eight most abundant species in point counts. The White-tipped Dove (*Leptotila verreauxi*) was the species with the highest IPA value (1.6), but columbids are not customary flock joiners, and this dove was never seen as a member of Faxinal flocks. On the other hand, two species found in flocks were not recorded in point counts: Epaulet Oriole (*Icterus cayanensis*) and Golden-rumped Euphonia (*Euphonia cyanocephala*). These species was encountered in a few flocks and in qualitative avifaunal surveys too. The Streaked Xenops (*Xenops rutilans*) represents a special case: whenever recorded, this species was associated with flocks ($n = 7$), even on the unique occasion when it was contacted in point counts. Among the two common dietary groups and clades in flocks, insectivores and omnivores passerines, there was a significant difference on relative abundance between flocking and non-flocking species ($U = 252.0$, $P = 0.005$, Mann-Whitney U-test). Fifteen species of omnivores and insectivores recorded in point counts were not recorded in mixed-species flocks, 60% of them with IPA inferior to 0.1. Twelve others species were not detected nor in flocks, neither in point counts – each was recorded only one or two times since 2004 year at Faxinal during qualitative surveys.

Eighty seven flocks contacted (95% of 92 flocks) had at least one of the seven core species, and 71% ($n = 65$ flocks) had two or more core species co-occurring. Considering the characters listed to be attributable to a nuclear species, the only core species that played the role of nuclear was the Red-crowned Ant-tanager. This bird was the fifth more regular species in flocks, had a highly gregarious behavior and is unusually conspicuous in voice and behavior. Furthermore, it behaved as leader in most flocks where it participated.

We investigated the independence of co-occurrences inside flocks for 18 species that occurred in five or more flocks. Of the 153 possible pairwise comparisons, there were 12 significant positive associations (TABLE 3), indicating that these species' pairs joined flocks together more frequently than expected by chance. Analyzing the pattern of pair formation in the significant positive co-occurrences, we can note that all involved species pairs shared the same vertical strata, more than the same diet type (TABLE 4). In the same way, all the three negative co-occurrences involved species utilizing distinct forest strata. Marginally significant positive co-occurrence were recorded between Tropical Parula and Chestnut-bellied Euphonia ($G = 3.3$; $P = 0.07$). Nearly significant negative co-occurrences occurred between Tropical Parula and Red-crowned Ant-Tanager ($\chi^2_1 = 3.8$, $P = 0.05$), as well as Bananaquit and Mottle-cheeked Tyrannulet ($G = 3.6$; $P = 0.06$). Bananaquit was the unique species that had more negative than positive co-occurrences, and only White-throated Spadebill (*Platyrinchus mystaceus*) had no significant co-occurrences among pairwise comparisons. The total number of significant occurrences, either positive or negative, represents 10% of the 153 pair combinations.

The observed *V*-ratio for the null model comprising all flocking species was not significantly smaller than expected by chance (observed index = 1.63, expected index = 1.86, $p = 0.05$). A second analysis was performed isolating the microhabitat requirement variable, and null models were generated for canopy and understory/midlevel species isolated. Again, the observed *V*-ratio for canopy species was not significantly smaller than that expected by chance (observed index = 0.99, expected index = 1.14, $p = 0.05$), but was significantly smaller for understory/midlevel species, (observed index = 1.10, expected index = 1.30, $p = 0.03$), although we interpret this difference as biologically meaningless, considering the little difference between observed and expected values.

By and large, the mean richness and size of flocks occupied by the ten most regular joining species was greater than the average mean of the attributes, i.e., 4.2 species per flock and 6.8 individuals per flock (TABLE 5). The difference in mean richness was significant for Golden-crowned Warbler, Tropical Parula, Variable Antshrike, and Ruby-crowned Tanager, indicating that flocks where each of these species joins are richer than the average of flocks found in Faxinal. By its turn, the difference in mean size was significant for Golden-crowned Warbler, Variable Antshrike, Red-crowned Ant-Tanager, Ruby-crowned Tanager, and Chestnut-bellied Euphonia, indicating that flocks where each of these species participated are larger than the average of flocks found in study site. However, the flocking regularity of a given species was not correlated with the mean size of flocks occupied by him ($r = -0.24$, $F = 1.6$, $P = 0.2$, Pearson correlation, linear transformation). None of the ten most regular species occurred in flocks where the mean was less than 4.2 species or 6.8 individuals per flock. A reversal tendency was found in flocks where only one core species was present, being these flocks significantly smaller and less rich than the average.

The cluster analysis resulted in three significant groups or flock types with very dissimilar sizes (FIGURE 2). One unique group clustered almost all the sample units (95% of flocks recorded). The remainder two groups are composed by few sample units, representing flocks with occasional and rare flocking species. (For instance, sample unit 4 was a flock composed by Blue Dacnis [*Dacnis cayana*] and Rufous-headed Tanager [*Hemithraupis ruficapilla*]). As the classification is highly dependent on the cluster and similarity methods employed (Pielou 1984, James and McCulloch 1990), we performed subsequent analysis varying both cluster method (average linkage) and similarity measures (percentage remoteness). All of them resulted in similar dendrograms. These results attest the great similarity in the composition of flocks in Faxinal.

Agonistic interactions were noted five times among five species. All interactions were intraspecific – a pair of Squirrel Cuckoo, a group of Restinga Tyranulet in persecution, two males of Chestnut-bellied Euphonia, two males of Ochre-collared Piculet (displaying as in Sick 1997:508), and one male Red-crowned Ant-Tanager attacking an immature individual.

FLOCK SEASONALITY

Flocks' formation was a year-round phenomenon at Faxinal (FIGURE 3). May was the month with the maximum number of flocks detected per hour of field work (0.37 flocks per hour), followed by July (0.35 flock per hour). After July, there was a decrease in the monthly number of flocks encountered, reaching the minimum values in November (0.08 flocks per hour). After that, number of flocks returns to increase in February, with a new but less pronounced decrease in March, followed by an increase in April. Another fall was observed in June, roughly during the middle of southern hemisphere winter.

The richness of flocking species varied significantly between months (F = 2.1, df = 10, P = 0.03) and between breeding and non-breeding season (U = 637.5, P = 0.01) (FIGURE 4). The mean number of species per flocks was higher in non-breeding (4.7 ± 0.3, 2 to 13 species) than in breeding season (3.3 ± 0.2, 2-6 species). Highest means were found in May and June (5.7 ± 0.7 for both months); lowest means were found in September and October (2.5 ± 0.3 and 2.3 ± 0.3, respectively). The same monthly difference was observed in flock size (F = 2.4, df = 10, P = 0.01), with the number of individuals per flock significantly higher in the non-breeding season (U = 669.0, P =

0.02) (FIGURE 4). The mean number of individuals per flocks was 7.5 ± 0.5 in non-breeding season (2-19 individuals) and 5.5 ± 0.5 in breeding season (2-13 individuals). Again, highest means were found in May and June (8.9 ± 0.9 and 9.4 ± 1.6, respectively) and lowest means were found in September and October (4.0 ± 0.8 and 4.0 ± 1.3, respectively), that is, the same months of highest and lowest richness values.

DISCUSSION

FLOCK COMPOSITION AND STRUCTURE

Mean flock richness and size at Faxinal was the lowest known for the Atlantic Forest (TABLE 6), may be reflecting the latitudinal situation of the study area and/or his fragmented nature. It is known that there is a latitudinal gradient of richness for many taxa, which decrease from southeastern to southern Atlantic Forest (Costa and Leite 2000, Brown and Freitas 2000, Bini et al. 2004). Therefore, Develey and Peres (2000) suggest that flock species richness reflects the total species richness gradient, wich thus should be lower in higher latitudes. Similar trends in decreasing number of joining species according the increase of latitude were reported for Middle America (King and Rappole 2000). Indeed, the fragmentation is a process that culminates in local extinction of some sensitive bird species, as has been documented in some sites of Atlantic Forest (Willis 1979, Aleixo e Vielliard 1995, Christiansen and Pitter 1997, Aleixo 2001, Willis and Oniki 2002, Ribon et al. 2003, Santos 2004, Antunes 2005). One effect found on mixed flocks, attributable to fragmentation, is the loss of species and the consequent reduction on flock species richness (Maldonado-Coelho and Marini 2000, Tellería et al. 2001, Maldonado-Coelho and Marini 2004). So, biogeographic trends and anthropic impacts must probably reduce the richness of bird assemblage in Faxinal, diminishing the available species pool to sustain the composition of mixed-species flocks.

Other possible explanation for the low richness and size of flocks in Faxinal may be related to habitat structure. Seki and Sato (2002) showed that the mixed-species flock attendance rate by tits (Paridae) increased after the severe disturbance caused by a typhoon in Japan. Reduced vegetation cover could have caused the observed behavioral changes as a result of the increased predation risk. Inversely, high vegetation density, at least in understory, can reduce the propensity of some species to join the flocks, as a result of increased protection against visually oriented predators. Furthermore, it is possible that richness and size values of Faxinal's flocks were underestimated, as some shiny species may have been overlooked do to the foliage thickness (Oniki 1971). However, we think that shiny species eventually not detected in flocks are so rare that their non-inclusion in the analysis will not change substantially the results discussed here.

At Faxinal, most species were represented in flocks by single individuals, less frequently by pairs or couples. Red-crowned Ant-Tanager had the highest average number of individual per flocks, what is related to its gregarious behavior. This species is commonly found on small familiar groups (Isler and Isler 1987). However, their groups are not numerous, and the maximum number of individuals inside flocks was of six (*n* = 3 of 28 records in flocks), being more common see three to four individuals integrating mixed-species flocks (*n* = 8 and *n* = 11, respectively). This tanager was the unique species that fulfilled all the attributes of a nuclear species in Faxinal. Nuclear function has been commonly attributed to the Red-crowned Ant-Tanager in a number of studies in Atlantic Forest (Bencke 1996, Maldonado-Coelho and Marini 2003, 2004), as well as in other neotropical forests (Willis 1960), although some authors put doubts about its fully efficacy on maintenance of the flocks' cohesion, in view of its non-specialized mixed flock behavior (Develey and Peres 2000). Unicolored Antwren was more frequently seen in couples (*n* = 33) than isolated (*n* = 6) or in little groups (≥ 3, *n* = 6) in mixed-flocks. Number of individuals per flock of Restinga Tyrannulet, Ruby-crowned Tanager, Golden-crowned Warbler, and Tropical Parula suggest a year-round bond couple. The remainder regular joining species has mean number of individuals per flocks more compatible with the pattern of pair or solitary habits.

Although the Unicolored Antwren has not reached the previously defined mean number of individuals, we recognize it as a nuclear species, along with Red-crowned Ant-tanager, because they show all the remaining attributes of nuclears, including the gap-crossing behavior (*n* = 6 of *N* = 28). Golden-crowned Warbler remained most of the time in front of flocks (67% of 21 records), uttered persistent calls when flocking, and was a core species, but it do not characterize as a nuclear species because it was not intraspecifically gregarious. Furthermore, even so staying in front of flocks, it does not leaded them, limiting itself to close follows the nuclears in most situations. However, we do not discard the possible leading and nuclear role of the warbler, as recorded for this and other *Basileuterus* species elsewhere (Powell 1979, Maldonado-Coelho and Marini 2000, 2003, Ghizoni-Jr, and Azevedo 2006), as it was recorded crossing gaps first then other associates in the few flocks where Red-crowned Ant-tanager or Unicolored Antwren was not present (*n* = 3 of *N* = 13). Evidently, the designation of a species as nuclear is highly dependent on the number and importance of sociobiological characters thought to be attributable to them. For instance, Goodale and Kotagama (2005) showed that a nuclear species less gregarious, but more prone to emit alarm calls, was as effective as a nuclear and very gregarious species in to promote the attraction of satellite species. Perhaps intraspecifically gregariousness and related characters are as important as alarm or leading behavior itself. A more embracing and ecologically reasonable number of nuclear species is achieved if we consider leading as the chief behavioral trait responsible for the organization of the membership movements.

In the tropics, mixed-species flocks are generally comprised by a pair, or familiar group, of each flocking species (Croxall 1976, Munn and Terborgh 1979, Powell 1979, Gradwohl and Greenberg 1980, Alves and Cavalcanti 1996, Jullien and Thiollay 1998). As long we know, in Atlantic Forest it is not different (Davis 1946, Stotz 1993, Machado 1999). Hence, the size of tropical flocks is highly correlated with their richness, and the increase in flock size is do to addition of species instead the addition of individuals (Powell 1985, Graves and Gotelli 1993). At Faxinal we verified that the bulk of flocking species are represented by a mean of one or two individual per flock, what are according to the pattern found in forest and open areas from tropical sites. Another data reinforcing the idea of increase of flock size by addition of species are that: (1) monthly peaks of higher and smaller mean number of individuals are the same for the mean number of species; (2) few intraspecific agonistic interactions were observed inside the flocks, indicating a structure based on pair formation or solitary birds; (3) none species exceed the mean of four individuals per flocks, and only two species reached or exceeded the limit of two individuals per flock. A different pattern was found in Taiwan, a subtropical site, where the abundance of only one species (the Grey-cheeked Fulvetta, *Alcipe morrisonia*) was the chief factor affecting flock size (Chen and Hsieh 2002). Although Rio Grande do Sul lies within the range of subtropical region as Taiwan, the relationship between flock size and number of flocking species are the same seen in more tropical regions. This pattern is almost certainly related to phylogenetic constraints. The means of the species with larger number of individuals per flock is not much different from the total mean of flocks in Faxinal. Instead what is exemplified by migrants in Central America and residents in

Taiwan (Hutto 1994, Chen and Hsieh 2002), no Atlantic Forest species form monospecific flocks with hundreds of individuals (except certain parrots and nomadic finches, which are species not prone to integrate mixed flocks). In fact, few species average more than ten or twenty individuals either in monospecific or multispecific flocks, and the exceptions include some ovenbirds and tanagers (Davis 1946, Willis 1989, Sick 1997, Machado 1999, 2002).

Davis (1946) found that young individuals do not integrate the flocks in large numbers, probably because there are not large numbers of fledged youngs in the neotropics, instead the large levels found in temperate regions. Hence, the mean number of individuals of each species in flocks throughout the year is nearly constant, with perhaps few exceptions (see comments on tanagers in Davis 1946:179). The negligible addition of youngs to flock structure is another factor influencing the relationship between flock size and joiners richness.

It is noteworthy that no species preferentially occurred on flocks whose richness and size averaged fewer than the overall means. It indicates that no joiner species avoid the bigger flocks or, alternatively, no species had preference by small flocks, although many of them where detected in small flocks some of the time. The same was found by Hutto (1994) in western Mexico. Indeed, occasional or rare species are must probable to be seen in the larger flocks, what is another data that corroborates the observation of increase in flock size by increase in species number. However, this do not imply that, the rarer a species is, the larger must be the size of the flock where it will join, as shown by regression analysis. But we must take care in to generalize that affirmation, in order to recognize the effect of increasing sample errors derived from decreasing species' sample sizes (Fowler and Cohen 1995).

Most species with significant differences had as size as richness of their flocks larger than the overall mean. Exceptions were found in some species. For instance, flocks having the Red-crowned Ant-Tanager was bigger than the average, but had no more species than the overall mean richness in Faxinal. This could be explained by the gregarious habits of that species, whose mean of 3.6 individuals per flock indicates an inflation in the size of flocks occupied by it. The reason why flocks with only one core species had fewer species and individuals than the average remains obscure, and may be better attributed to a statistical artifact.

Flock species richness was a subset of overall richness of bird assemblage of Faxinal. Although the low values of mean flock richness and abundance, the percentage of the species pool represented as membership in flocks was similar to that found elsewhere in Atlantic Forest biome (TABLE 6). Indeed, the pattern of taxonomic representation in flocks agrees with what was found by other researchers (Davis 1946, Machado 1999). At Faxinal, a nearly equal representation of his respective pools is presented by suboscines and oscines passerines. However, non-passerines had a negligible set of flocking species representing its pool. The same was found by Davis (1946) and Machado (1999) in eastern Brazil, including the same or much related species that flocked in Faxinal (the Squirrel Cuckoo and four woodpeckers). Regarding to woodpeckers, they are commonly cited members of flocks throughout the world, although in most cases they usually are not classified as regular participants (Steering and Ickes 2001). Apparently, there is a distinguishable trend of taxonomic participation on flocks of Atlantic Forest. Why so? The reasons for that disparate participation of passerines and non-passerines, related to the number of species, should be investigated in terms of the distribution of dietary niches and habitat preferences among the clades. Although the number of ensembles was even distributed through clades (11, 10 and 9 ensembles for non-passerines, suboscines and oscines, respectively), the non-passerines have some unique ensembles that do not participated in mixed flocks, as soil frugivores, grassland omnivores and aquatic omnivores, whose habitat preferences hinder their adjoin to flocks. Indeed, other ensembles where also not or poorly represented as among non-passerine as in passerines flocking species, such as nectarivores, large canopy frugivores and edge seedeaters. Regarding to the nectarivores, they were the most rich ensemble of non-passerines, composed by nine species of hummingbirds, all of them primarily non-flocking species. The unique flock member among this ensemble was the Bananaquit, an oscine bird. By its turn, suboscines and oscines are less diversified in dietary niches, and small to medium-sized insectivores and omnivores predominate among passerines. Not surprisingly, the few non-passerines flocking species are canopy or twig insectivores. On the other hand, almost all ensembles in suboscines and oscines are represented in mixed flocks. Aleixo (1997) observed the same pattern of non-participation related to certain ensembles. Again, frugivores and nectarivores were in its majority non-flocking species, although among them there were some common birds in the assemblage studied by him.

One singularity of Faxinal, in relation to many sites, is the rarity of woodcreepers (dendrocolaptids) as flock members. Woodcreepers figures among the most regular flock joiners in virtually all published works in Atlantic Forest, detaching *Sittasomus griseicapillus*. Once again, the positive correlation between flocking regularity and relative abundance explain that singularity. Woodecreepers are almost absent in Faxinal's flocks because they are not common on the avian assemblage. Despite the high richness found at Faxinal (six species, corresponding to 85% of forest woodcreepers listed for Rio Grande do Sul, Bencke 2001) the unique flocking species was *Dendrocolaptes platyrostris*, by the way the most contacted woodcreeper in point counts, as well as the most frequently observed in qualitative surveys. Even so, this species qualifies as a rare flock joiner, what is in accordance with its low IPA. Fragmentation and absence of certain microhabitat requirements can be the main reason of local rarity of dendrocolaptids, as this group is one of the most affected by reduction and impoverishment of forest area (Marantz et al. 2003, Poletto et al. 2004).

At Faxinal, the regularity of occurrence on flocks of a given species can be predicted on basis of its relative abundance. Apparently, this is a generalized mixed flock pattern throughout the world (Hutto 1994, Latta and Wunderle 1996, Aleixo 1997, Gram 1998). Indeed, we found a significant difference in relative abundance of flocking and non-flocking species, analyzing the two richest groups in flocks, the insectivores and omnivores passerines. That difference reinforces the strong correlation between abundance and flock regularity.

We found that most flocks in our study area had at least two regular species co-occurring. This indicate that there are a core of flock participants in Faxinal, giving a certain predictability in terms of species composition, instead of what was found by Stotz (1993) and Aleixo (1997) in eastern Brazil. Aleixo (1997) argued that, in his study area, the flocks will be composed by whichever co-occurring species within the home range of the most abundant species (White-bellied Warbler [*Basileuterus hypoleucus*] and Rufous-winged Antwren [*Herpsilochmus rufimarginatus*]), wich are not able to influence the formation and cohesion of flocks. Therefore, the structure of that flocks are highly variable in terms of component species. Indeed, as the pool of species in southeastern Brazil is richer than in southern forests, the composition of these flocks is more diversified. At Faxinal, flock structure appears to be more predictable than the observed for southeastern Atlantic Forest sites. Most flocks had not only one core species, but two or more of them. The great factor influencing the composition of flocks appears to be the almost omnipresence of a restricted group of abundant and well distributed species. Yet, the majority of species was uncommon or rare in flocks, occurring in less than ten percent of the flocks sampled. Therefore, the somewhat stable group of core species of mixed flocks in Faxinal is more correlated with the low diversity in bird assemblage than to particular behavioral traits of these species. That low diversity may lead to density compensation, where the abundance of few species increases with the local extinction of others (MacArthur et al. 1972, Wright 1980, Anjos 2004). In an Atlantic Forest fragment in southeastern Brazil, the density compensation was used to explain the high density of Golden-crowned Warbler (Aleixo and Vielliard 1995), the most abundant species in that, as well as in our study area. The same may be true for others passerines inhabiting different forest strata, as Tropical Parula in the canopy (Ghizoni-Jr. and Azevedo 2006), and Unicolored Antwren in thick understory. Moreover, all the regular species in flocks are well distributed in the swamp forest fragment, occurring in all point counts spread over the different forest physiognomies of Faxinal. Wherever a flock was formed, there are at least one or two core species in that local, making the flock composition predictable in certain manner. So, core species at Faxinal can be identified not only in basis of its high abundance, but by its high frequency on forest as a whole.

The pattern of a group of core species found in Faxinal, including one to three nuclear species, resembles the “nucleus-complex” described by Machado (2002). This “nucleus-complex” is a group of at least five species that play together the role of aggregation and maintenance of the flock cohesion, in the absence of a typical nuclear species.

Another evidence for the somewhat stable nature of flock species composition in our study area is the tendency of accumulation curve of species for flocks, when compared to the curve of Faxinal bird assemblage (FIGURE 5). Whereas Faxinal curves proceeds on accumulating new species, probably as an effect of the turnover characteristic of fragments (Brown and Kodric-Brown 1977, Opdam 1991, Haila et al. 1993), the curve of sufficiency for flocks seems to reach its asymptote. This may indicate that, whatever species is incorporated to bird assemblage of Faxinal, few of them will increase the richness of flock composition. Most of this occasional species should have low chances of establishment, perhaps do to “empty niches” promoted by the most abundant and regular flock species members. It is notorious that all of the twelve species not recorded in flocks or in point counts were recorded only one or two times in qualitative surveys at Faxinal. Therefore, they have minimal chance to integrate flocks. In resume, it is possible that low diversity, chance colonization and density compensation are key processes influencing the composition and stability of flocks in small southern Atlantic Forest fragments, leading to a more predictable species composition.

That stable composition of core species possibly lead to the impossibility of recognize different flock structural types as nearly discrete entities. In fact, the cluster analysis did not recognized well separated types of flocks. The three groups formed involved one major group containing 95% of all flocks, and two others with discrepant flock members (very occasional associations of edge species or between rare canopy species). The high similarity between flocks demonstrates once more their predictability in terms of species composition, what preclude the recognition of well defined structural types. A clear dichotomy is described for some neotropical sites (Munn 1985, Aleixo 1997, Maldonado-Coelho and Marini 2003), involving canopy and understory flocks. However, these two types of flocks related to distinct strata may coalesce to form larger flocks where the forest canopy is low (Stotz 1993). By and large, we could recognize in our study area canopy and understory flocks as well, but that separation was not clear on dendrogram, at least by the chosen significance level. (See in FIGURE 4 the dichotomy involving the major group, by the distance value of 3.5. The group at left represents understory flocks; the group at right represents canopy flocks). Moreover, many flocks from a given strata contained one or more species from the other, showing that Faxinal's flocks may be formed around a nucleus of core species from a certain forest layer, but being able to attract supplemental species from distinct habitats, possibly as an effect of the low canopy height. This mix of species from different layers homogenizes the flock composition, attenuating the effect of habitat preference on the formation of strict structural types.

Although no distinct flock types can be recognized in Faxinal based on species composition, certain pairs of species tended to co-occur in the same flocks more than expected by chance. Inversely, a few pairs showed negative co-occurrences. One factor for positive (and negative) co-occurrences is the share or not of the same habitat preference (Hutto 1994, Latta and Wunderle 1996). Therefore, two species are more probable to be encountered in the same flocks as a result of them being restricted to the same habitat. If we consider two different forest strata (understory and canopy) as two distinct habitats, we will find that all positive co-occurrences involved species occupying the same strata. In the same way, all the significant negative co-occurrences involved species from distinct strata. However, at least some of these few negative co-occurrences may be reflecting a statistical artifact rather than an authentic ecological phenomena (Latta and Wunderle 1996). Distinct habitats can be recognized in Faxinal not only vertically, but also horizontally (heterogeneity), and again co-occurrences may be recognized as a result of two species having mutual horizontal habitat preference.

Hutto (1994) presumed that another possible phenomenon explaining the positive co-occurrences is the mutual or unilateral dependence, when at least one member of the species-pair joins the flocks more likely if their counterpart is present. At Faxinal, only one unilateral dependence was observed, involving the Black-capped Foliage-gleaner, who only joined flocks where Red-crowned Ant-Tanager was present. Social mimicry may be the chief factor influencing this restricted interaction (see below). The rest of positive interactions involved species that also occurred in flocks where their counterparts were not present. Therefore, positive associations are possibly not obligate associations, and the presence of a given species is not a crucial factor influencing the joining of another species. Hutto (1994) found similar results in Mexican tropical deciduous forests.

Some of these positive co-occurrences may be explained by the hypothesis involving associations among species sharing similar color patterns, what is related to social mimicry working in mixed flocks (Moynihan 1962, 1968, Barnard 1979, Willis 1989). A possible adaptive reason for the social mimicry is the enhancement on the effectiveness of the confusion effect, providing better protection against predation (Chen and Hsieh 2002). Aleixo (1997) suggested that association patterns, linked to species with similar plumage coloration, might occur in flocks without nuclear or sentinel species and low stability. Using ordination techniques, he recognized a “brown group”, formed by Red-crowned Ant-Tanager, White-eyed Foliage-gleaner (*Automolus leucophthalmus*), and Lesser Woodcreeper (*Xiphorhynchus fuscus*). Perhaps the above cited co-occurrence between Red-crowned Ant-Tanager and Black-capped Foliage-gleaner is related to this “brown group”, wich seems to be a recurrent association in Atlantic Forest (Willis 1989, Bencke 1996). At Faxinal, besides the “brown” group, we recognized another association of similar type, composed by Tropical Parula and

Bananaquit, two species that are small, canopy dwellers, and blue-and-yellow colored. This association may be called “blue-and-yellow” group, and additional studies over the vast area of sympatry between these two passerines (see distributional maps in Ridgely and Tudor 1989) will reveal if it is a common and recurrent aspect of their behavioral ecology. Another species possibly linked to this “blue-and-yellow” group seems to be the Chestnut-bellied Euphonia, as judged by his nearly significant positive co-occurrence with Tropical Parula. Similar “blue-and-yellow” groups are found in northern Andes, formed by tanagers (*Tangara* spp.) and honeycreepers (*Diglossa* spp.) (Moynihan 1962, Barnard 1979). A third type of co-occurrences attributed to similar-colored species involved the Ruby-crowned Tanager, the Sayaca Tanager (*Thraupis sayaca*) and the Blue Dacnis. All are omnivores and predominantly blue birds, although varying strongly in tonality. They may perform a “blue omnivore” group, as one species positively co-occurred with each of the two others more then expected by chance. However, the association between “blue-and-yellow” and “blue omnivore” species in Faxinal not leaded to the formation of flocks having exclusively these species. In other words, the preferential co-occurrence of those species does not avoid the entrance of “disparate” species in the flocks. This probably prevented the recognition of these similar-colored species groups as well defined structural types in cluster analysis.

The null model analysis showed that the number of negative co-occurrences, which is related to the checkerboard distribution pattern (Diamond 1975), is lower than expected by chance. Therefore, we can reasonably infer that competitive processes are not working in to limit the number of species co-occurrences within flocks of Faxinal. Alternatively, we can suppose that territoriality do not play a role in to limit the number of species inside a given flock in the study area. One reason is the limited number of cogenerics and niche correlated species with similar abundances present in Faxinal’s flocks. No genera had two cogenerics nearly equally frequent in flocks (for instance, Chestnut-bellied Euphonia against other euphonias, and Sayaca Tanager against Azure-shouldered Tanager), so the dissimilar abundances may explain the limited numbers of negative co-occurrences. An exception to the low number of niche correlates is the great number of edge and canopy tanagers and correlates, wich looks very similar in size, microhabitat requirements and foraging maneuvers (Barcellos, pers. obs.). Perhaps more subtle habitat preferences or nuances of foraging behavior not easily perceptive to observers are acting in to promote the co-existence of apparently similar species.

Our initial null model analysis included in the same original matrix species usually encountered in distinct vertical strata and flocks recorded in distinct physiognomies. It would be predicted, therefore, a higher number of negative co-occurrences, by reason of that dissimilarities among the species and the flocks. However, even so the observed negative co-occurrences involved pairs of distinct strata-dweller species, this number of co-occurrences was fewer than the expected by chance, indicating again that habitat preferences were not a barrier to the coexistence on flocks of species with very dissimilar habitat selection. The same may be with regard to the occurrence by physiognomies. These results are in consonance with that achieved by cluster analysis, showing that the low canopy perhaps prevents the split of flocks in the vertical space. An additional explanation involves the behavior of flocking members themselves, being possible that flock memberships consistently alter their foraging heights when flocking (Pearson 1971, Suhonen 1993, Machado and Rodrigues 2000), leading them to forage in not normally explored strata or physiognomies.

Migrants had a practically null participation on composition and structure of Faxinal’s flocks. The absence of migrants is another factor explaining the low richness of flocks in Faxinal, as their presence contributes to enlarge the richness and size of flocks elsewhere (Develey 2001). However, this participation of migrants may be more pronounced in montane than in lowland Atlantic Forest (Develey and Peres 2000). Develey and Peres (2000) working on the lowland Atlantic Forest of São Paulo, and Ghizoni-Jr. and Azevedo (2006), studying the flocks of Santa Catarina, found the same little influence of migrants on flock richness and size. Additional studies involving more areas are needed in order to verify if this is a widespread pattern in southern Brazilian coastal plain.

The nearly negligible participation of migrants in the few lowlands of Atlantic Forest studied contrast with their great participation on Central American forests situated at corresponding latitudes on northern hemisphere. Why are there so many differences in social behavior of migrants on both high latitudes? The explanation seems to be somewhat obvious. While in Central America the migrants arrive in a non-reproductive condition, the reverse occurs in southern South America. When they arrive at its southern migration grounds, South American migrants strike just at their breeding season. As soon as arrive, they begin to involve in reproductive activities, specially territory settlement (Sick 1983).

FLOCK SEASONALITY

A clearly seasonal pattern emerged from the data of frequency, composition and structure of mixed-species flocks in Faxinal swamp forest. Flocks were more frequent, significantly richer and had larger number of individuals in non-breeding season (fall and winter) than during breeding season (spring and summer). The frequency of flocks was highest from May to July, but the low value observed in June can be attributed to unsavory weather conditions, when winter had more severe days during the sample period and should have affected bird activity or their detection. A decrease on flock detectability observed after July, may be represents either the beginning of reproductive moult (Davis 1945, Mallet-Rodrigues 2005) and the first territorial activities both from migrants and residents. A new increase in flock frequency occurred after November, may be representing the final of breeding for many species.

Number of mixed flocks detected per hour of field work is a measure that permits direct comparisons with other works, allowing the inspection of frequency of flock formation from different areas. At Parque Estadual de Intervales, in the highlands of southeastern Brazil, Machado (1999) found overall higher values of flocks per hour than we did in Faxinal. In that site, maximum number of flocks per hour was found in August (1.27) and the minimum in January (0.26), either well above our respective data. Unfortunately, we were unable to find other works that expressed their results in terms of flocks per hour, so we cannot affirm that flock formation is more frequent in southeastern than southern Brazil.

Months of highest (May and June) and lowest (September and October) values were the same for both flock size and number of flocking species. These consonance shows once more the close relationship between flock size and flock richness. Again, the Faxinal’s pattern of flock seasonality agrees with the observed elsewhere in Atlantic Forest (Davis 1946, Machado 1999, Develey and Peres 2000). Differential availability of food resources in time and the increase of investment in breeding activities are largely accepted explanations for temporal changes in flock attributes worldwide (Moynihan 1962, Powell 1985, Develey and Peres 2000).

Working on montane Atlantic Forest of eastern Brazil, Davis (1946) and Machado (1999) found a diverse relationship between frequency and size of flocks, with a reduction on flock frequency during the breeding season (as found elsewhere), but with an increase in mean richness and abundance of flocks during the same period. That inverse relationship between frequency and diversity of flocks was explained by

Machado (1999) in terms of an “accumulation” of species in the few flocks formed, as if the major diversity was a consequence of the lower frequency. However, the same author recognizes that other factors possibly are acting over the enlarging mean size of flocks during the breeding season, suggesting that the “nucleus-complex” maybe another explanation. By his turn, Davis (1946) argued that the large peaks found by him in January and March are do to several immature tanagers joining the few flocks. Perhaps that inverse relationship is characteristic of flocks formed in montane forests, but additional data focusing on a possible altitudinal influence are necessary.

Concluding, mixed-species flocks in Faxinal resembles other Atlantic Forest flocks, especially that from lowlands, in representation of migrants/residents and passerines/non-passerines species, as well as in peaks of richness in non-breeding season. However, even in the season of higher richness, the number of species in Faxinal is the smallest known in Atlantic Forest.The low mean richness of these flocks probably is a result of latitudinal trends, or of fragmentation, or both.

ACKNOWLEDGMENTS

We are grateful to Departamento de Florestas e Áreas Protegidas of Secretaria do Meio Ambiente of Rio Grande do Sul state, for the pemissions to work in Parque Estadual de Itapeva. We thank the CAPES for research grants. Patrick Colombo provided logistic support, and Pedro Develey, Sandra Hartz, J. M. Vielliard, Iury Accordi and Adriano Melo provided valuable suggestions, specially during planning phase of this work. Clarissa Britz Hassdenteufel, Ricardo Dobrowolski, Roberson “Boliviano”, Ricardo Dalbem, Anelise Azevedo and Cláudia Brandt assisted in field work. Leandro Duarte helped with cluster analysis, and Jéssica Schmitz with the English. AB wishes to dedicate this work to his mother, Neusa Barcelos, and to his grandfather, Florindo Barcellos (*in memorian*).

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TABLE 1. Attributes of 47 landbirds species found in mixed-species flocks at Faxinal, southern Brazil. Weights in g.

English name	Species	FR[a]	N[b]	IPA[c]	I[d]	T[e]	S[f]	Ensemble[g]	Weight
NON-PASSERINES									
Squirrel Cuckoo	*Piaya cayana*	4.35	4	0.069	1.5	6	U	MI	134
Ochre-collared Piculet	*Picumnus temminckii*	16.30	15	0.388	1.2	18	C	TI	11
White-spotted Woodpecker	*Veniliornis spilogaster*	1.09	1	0.131	1	1	R	TI	40
Blond-crested Woodpecker	*Celeus flavescens*	1.09	1	0.556	3	3	R	TI	154.5
SUBOSCINE PASSERINES									
Variable Antshrike	*Thamnophilus caerulescens*	31.52	29	0.706	1.28	37	Re	UF	21.2
Rufous-capped Antshrike	*Thamnophilus ruficapillus*	1.09	1	0.150	1	1	R	EI	23
Unicolored Antwren	*Myrmotherula unicolor*	48.91	45	0.350	2.02	91	Re	MI	6.8
Rufous Gnateater	*Conopophaga lineata*	2.17	2	0.400	1.5	3	R	US	23
Planalto Woodcreeper	*Dendrocolaptes platyrostris*	1.09	1	0.163	1	1	R	UL	65
Chicli Spinetail	*Synallaxis spixi*	2.17	2	0.100	1.5	3	R	EI	12.5
Buff-browed Foliage-gleaner	*Syndactyla rufosuperciliata*	1.09	1	0.050	1	1	R	TI	25

English name	Species	FR[a]	N[b]	IPA[c]	I[d]	T[e]	S[f]	Ensemble[g]	Weight
Black-capped Foliage-gleaner	*Philydor atricapillus*	7.61	7	0.038	1.14	8	U	UF	21.5
Streaked Xenops	*Xenops rutilans*	7.61	7	0.006	1	7	U	TI	12.5
Sepia-capped Flycatcher	*Leptopogon amaurocephalus*	1.09	1	0.094	1	1	R	UF	13.7
Southern Beardless-Tyrannulet	*Camptostoma obsoletum*	3.26	3	0.619	1	3	U	CO	8.8
Mottle-cheeked Tyrannulet	*Phylloscartes ventralis*	9.78	9	0.125	1.67	15	U	MI	9
Restinga Tyrannulet	*Phylloscartes kronei*	27.17	25	0.331	1.56	39	Re	CI	9
Phylloscartes Tyrannulet	*Phylloscartes* sp.	1.09	1	0.000	1	1	R	–	–
Yellow-olive Flycatcher	*Tolmomyias sulphurescens*	2.17	2	0.031	1	2	R	MI	17
Fuscous Flycatcher	*Cnemotriccus fuscatus**	1.85	1	0.030	1	1	R	EO	14
White-throated Spadebill	*Platyrinchus mystaceus*	6.52	6	0.250	1.33	8	U	UF	9
Variegated Flycatcher	*Empidonomus varius**	3.13	1	0.100	1	1	U	EO	26.8
Unidentified Flycatcher	–	1.09	1	0.006	1	1	R	–	–
Swallow-tailed Manakin	*Chiroxiphia caudata*	7.61	7	1.175	1	7	U	UO	24.9
White-bearded Manakin	*Schiffornis virescens*	1.09	1	0.331	1	1	R	UO	25.4

English name	Species	FR[a]	N[b]	IPA[c]	I[d]	T[e]	S[f]	Ensemble[g]	Weight
White-winged Becard	*Pachyramphus polychopterus**	3.13	1	0.091	1	1	U	CI	24.5
OSCINE PASSERINES									
Rufous-browed Peppershrike	*Cyclarhis gujanensis*	3.26	3	0.756	1	3	U	CI	31
Red-eyed (Chivi) Vireo	*Vireo olivaceus**	3.13	1	0.700	1	1	U	CO	16
Southern House-Wren	*Troglodytes musculus*	2.17	2	0.569	1.5	3	R	EI	12
Rufous-bellied Trush	*Turdus rufiventris*	3.26	3	0.613	1	3	U	EO	73.4
Creamy-bellied Trush	*Turdus amaurochalinus*	2.17	2	0.575	1	2	R	EO	65
White-necked Trush	*Turdus albicollis*	2.17	2	0.263	1	2	R	UO	64.7
Bananaquit	*Coereba flaveola*	22.83	21	0.881	1.14	24	C	NI	10.2
Red-crowned Ant-Tanager	*Habia rubica*	30.43	28	0.275	3.61	101	Re	UO	40
Ruby-crowned Tanager	*Tachyphonus coronatus*	13.04	12	0.506	1.92	23	C	EO	26.5
Sayaca Tanager	*Thraupis sayaca*	6.52	6	0.338	1.67	10	U	EO	32.1
Azure-shouldered Tanager	*Thraupis cyanoptera*	2.17	2	0.063	1.5	3	R	EO	44
Fawn-breasted Tanager	*Pipraeidea melanonota*	2.17	2	0.088	2	4	R	CO	21

English name	Species	FR[a]	N[b]	IPA[c]	I[d]	T[e]	S[f]	Ensemble[g]	Weight
Tangara Tanager	*Tangara* spp.	4.35	4	0.069	1	4	U	EO	23
Blue Dacnis	*Dacnis cayana*	5.43	5	0.038	1	5	U	CO	15
Rufous-headed Tanager	*Hemithraupis ruficapilla*	3.26	3	0.013	1	3	U	CO	13
Unidentified Finch	–	1.09	1	0.000	1	1	R	–	–
Green-winged Saltator	*Saltator similis*	6.52	6	0.438	1.33	8	U	EO	43.5
Tropical Parula	*Parula pitiayumi*	38.04	35	1.425	1.5	51	Re	CI	9.1
Masked Yellowthroat	*Geothlypis aequinoctialis*	4.35	4	1.106	1.25	5	U	UF	13
Golden-crowned Warbler	*Basileuterus culicivorus*	54.35	50	1.113	1.72	86	Re	UF	10.1
Epaulet Oriole	*Icterus cayanensis*	1.09	1	0.000	3	3	R	EO	32.3
Purple-throated Euphonia	*Euphonia chlorotica*	1.09	1	0.088	1	1	R	CO	10.7
Golden-rumped Euphonia	*Euphonia cyanocephala*	1.09	1	0.000	2	2	R	CO	12.5
Chestnut-bellied Euphonia	*Euphonia pectoralis*	10.87	10	0.531	1.2	12	C	CO	15.5
Unidentified Euphonia	*Euphonia* sp.	2.17	2	0.006	1	2	R	–	–

[a] Proportion of flocks occupied by the species (flocking regularity).

[b] Number of flocks in wich the species was recorded.

[c] Index of punctual abundance.

[d] Mean number of individuals per flock.

[e] Total number of individual detections in flocks.

[f] Status as participant in flocks: regular (Re), common (C), uncommon (U), rare (R).

[g] Ensemble: (CI) canopy insectivores, (CO) small canopy omnivores, (EI) edge insectivores, (EO) edge omnivores, (MI) midlevel insectivores, (NI) nectarivores-insectivores, (TI) trunk and twig insectivores, (UF) understory birds eating small foliage arthropods, (UL) understory birds eating large ground arthropods, (UO) understory omnivores, and (US) understory birds eating small ground arthropods.

* Migratory species (summer resident, Belton 1994). Flocking regularity for these species was computed using only the number of flocks recorded during the months of the species permanence in study area.

TABLE 2. Richness and relative abundance by diet type or residence statuses of birds recorded in flocks and/or point counts in Faxinal, southern Brazil.

Categories	Flocks		Point counts		Total
	Richness	Abundance	Richness	Abundance	richness
All species	47	618	88	3688	90
Insectivores	24	394	40	1737	40
Omnivores	22	200	32	1306	34
Nectarivores	1	24	8	278	8
Frugivores	0	0	5	348	5
Granivores	0	0	3	19	3
Migrants	4	4	12	193	12
Residents	43	614	77	3495	79

TABLE 3. Number of co-occurrences in mixed-species flocks of the eighteen most regular flocking species (those recorded in more than four flocks) in Faxinal, southern Brazil. Significant positive co-occurrences, according Chi-square and *G*-test ($P < 0.05$) are underlined. Significant negative co-occurrences are in bold and underlined.

		Species																
Species	*n*	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	CO[a]
1 Golden-crowned Warbler	50	27	16	21	20	12	10	10	6	8	4	6	1	6	4	4	2	1	1/0
2 Unicolored Antwren	45	–	14	20	14	11	**4**	12	6	4	3	1	3	4	5	1	2	1	2/1
3 Tropical Parula	35		–	12	6	17	14	**2**	4	7	5	3	0	3	0	1	3	2	2/1
4 Variable Antshrike	29			–	9	8	5	4	5	6	2	4	1	3	2	3	3	1	2/0
5 Red-crowned Ant-Tanager	28				–	5	**2**	2	2	4	1	4	7	2	3	3	2	0	1/1
6 Restinga Tyrannulet	25					–	5	3	2	6	2	2	1	1	0	1	1	2	2/0
7 Bananaquit	21						–	1	6	2	3	1	0	2	0	0	2	2	1/2
8 Ochre-collared Piculet	15							–	2	3	1	0	0	3	2	1	0	0	1/1
9 Ruby-crowned Tanager	12								–	1	0	2	0	1	2	3	4	3	2/0
10 Chestnut-bellied Euphonia	10									–	0	2	0	0	0	1	0	0	1/0

		Species																	
Species	*n*	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	CO[a]
11 Mottle-cheeked Tyrannulet	9										–	2	0	3	0	0	1	1	1/0
12 Swallow-tailed Manakin	7											–	0	2	0	3	2	0	1/0
13 Black-capped Foliage-gleaner	7												–	0	0	0	0	0	1/0
14 Streaked Xenops	7													–	1	0	1	1	1/0
15 White-throated Spadebill	6														–	0	0	0	0/0
16 Green-winged Saltator	6															–	2	1	1/0
17 Sayaca Tanager	6																–	3	2/0
18 Blue Dacnis	5																	–	2/0
Total	92																		12/3

[a] Total number of significant positive/negative co-occurrences of each species.

TABLE 4. Coefficient of interspecific association of significant positive and negative co-occurrences of flocking bird species according to vertical distribution and diet type of species paired in flocks at the swamp forest of Faxinal, southern Brazil. Understory and midlevel ensembles categories pulled as understory. Significant negative co-occurrences are in bold. Both chi-square and G-test with df = 1 and $P < 0.05$.

Significant association[a]	Test value	C[b]I[c]/CI	CI/CO	CI/CN	CI/UI	CO/CO	CN/UO	CN/UI	UO/UO	UO/UI	UI/UI
1-4	$\chi^2 = 4.558$; $P = 0.0328$										0.23
2-4	$\chi^2 = 5.693$; $P = 0.0170$										0.25
2-7	$G = 8.6595$; $P = 0.0033$							**-0.27**			
2-8	$G = 5.7551$; $P = 0.0164$										0.21
3-6	$\chi^2 = 8.332$; $P = 0.0039$	0.30									
3-7	$\chi^2 = 7.950$; $P = 0.0048$			0.26							
3-8	$G = 3.8432$; $P = 0.049$				**-0.11**						
5-7	$G = 5.0215$; $P = 0.0250$						**-0.23**				
5-13	$G = 13.3238$; $P = 0.0003$									0.24	
6-10	$G = 3.9137$; $P = 0.0479$		0.18								

Significant association[a]	Test value	C[b]I[c]/CI	CI/CO	CI/CN	CI/UI	CO/CO	CN/UO	CN/UI	UO/UO	UO/UI	UI/UI
9-16	$G = 7.6232$; $P = 0.0058$					0.21					
9-17	$G = 4.6935$; $P = 0.0303$					0.23					
11-14	$G = 3.8961$; $P = 0.0484$	0.29									
12-15	$G = 6.0526$; $P = 0.0139$								0.39		
16-17	$G = 8.0795$; $P = 0.0045$					0.48					
Total		1	1	1	2	3	1	1	1	1	3

[a] Number codes of significant associations: 1 - Golden-crowned Warbler, 2 – Unicolored Antwren, 3 – Tropical Parula, 4 - Variable Antshrike, 5 - Red-crowned Ant-Tanager, 6 - Restinga Tyrannulet, 7 – Bananaquit, 8 - Ochre-collared Piculet, 9 - Ruby-crowned Tanager, 10 - Chestnut-bellied Euphonia, 11 - Mottle-cheeked Tyrannulet, 12 - Swallow-tailed Manakin, 13 - Black-capped Foliage-gleaner, 14 - Streaked Xenops, 15 - Green-winged Saltator, 16 - Sayaca Tanager, 17 - Blue Dacnis.

[b] Codes for vertical distribution: (C) canopy, (U) understory.

[b] Codes for diet type: (I) insectivores, (O) omnivores, (N) nectarivores.

TABLE 5. The mean flock size and mean species richness of flocks where each of the ten most regular flocking species were recorded in Faxinal, southern Brazil. An asterisk indicates species means (or median) that significantly differs from the total mean (medians) of 92 mixed-species flocks sampled, at $P < 0.05$.

Species	Mean size (± SE)	Test	Mean species richness (± SE)	Test
Golden-crowned Warbler	8.1 (1.4)*	$t_{140} = 2.2$, $P = 0.03$	4.9 (1.3)*	$t_{140} = 2.1$, $P = 0.04$
Unicolored Antwren	7.0 (0.5)	$U = 1921.5$, $P = 0.5$	4.2 (0.3)	$t_{135} = 0.6$, $P = 0.5$
Tropical Parula	7.6 (0.7)	$t_{124} = 1.0$, $P = 0.3$	4.9 (0.4)*	$t_{124} = 7.4$, $P < 0.001$
Variable Antshrike	8.9 (0.6)*	$U = 833.0$, $P = 0.002$	5.7 (0.4)*	$t_{119} = 3.5$, $P < 0.001$
Red-crowned Ant-Tanager	8.7 (0.8)*	$t_{118} = 2.3$, $P = 0.02$	4.6 (0.5)	$t_{118} = 0.7$, $P = 0.5$
Restinga Tyrannulet	7.3 (0.7)	$t_{115} = 0.8$, $P = 0.4$	4.6 (0.4)	$t_{115} = 1.1$, $P = 0.3$
Bananaquit	7.6 (0.9)	$t_{111} = 0.7$, $P = 0.4$	5.1 (0.5)	$t_{111} = 1.7$, $P = 0.09$
Ochre-collared Piculet	7.1 (1.0)	$t_{105} = 0.4$, $P = 0.7$	4.4 (0.5)	$t_{105} = 0.7$, $P = 0.5$
Ruby-crowned Tanager	10.3 (1.1)*	$U = 252.0$,	6.5 (0.5)*	$U = 221.0$,

Species	Mean size (± SE)	Test	Mean species richness (± SE)	Test
		$P = 0.002$		$P < 0.001$
Chestnut-bellied Euphonia	10.0 (1.1)*	$t_{100} = 2.5$, $P = 0.01$	6.6 (0.5)	$U = 163.5$, $P = 3.3$
Flocks with one core species	4.1 (0.4)*	$t_{112} = -3.5$, $P < 0.001$	2.6 (0.2)*	$U = 566.0$, $P < 0.001$
Flocks with more than one core species	7.6 (0.4)	$U = 1.7$, $P = 0.1$	4.6 (0.3)	$T_{156} = 1.5$, $P = 0.1$
Flocks without core species	7.6 (2.6)	$t_{95} = 0.0$, $P = 0.9$	4.6 (1.3)	$t_{95} = 0.3$, $P = 0.7$
All flocks	6.8 (0.4)	–	4.2 (0.2)	–

TABLE 6. Composition and structure attributes of mixed-species flocks in different areas of Atlantic Forest in Brazil.

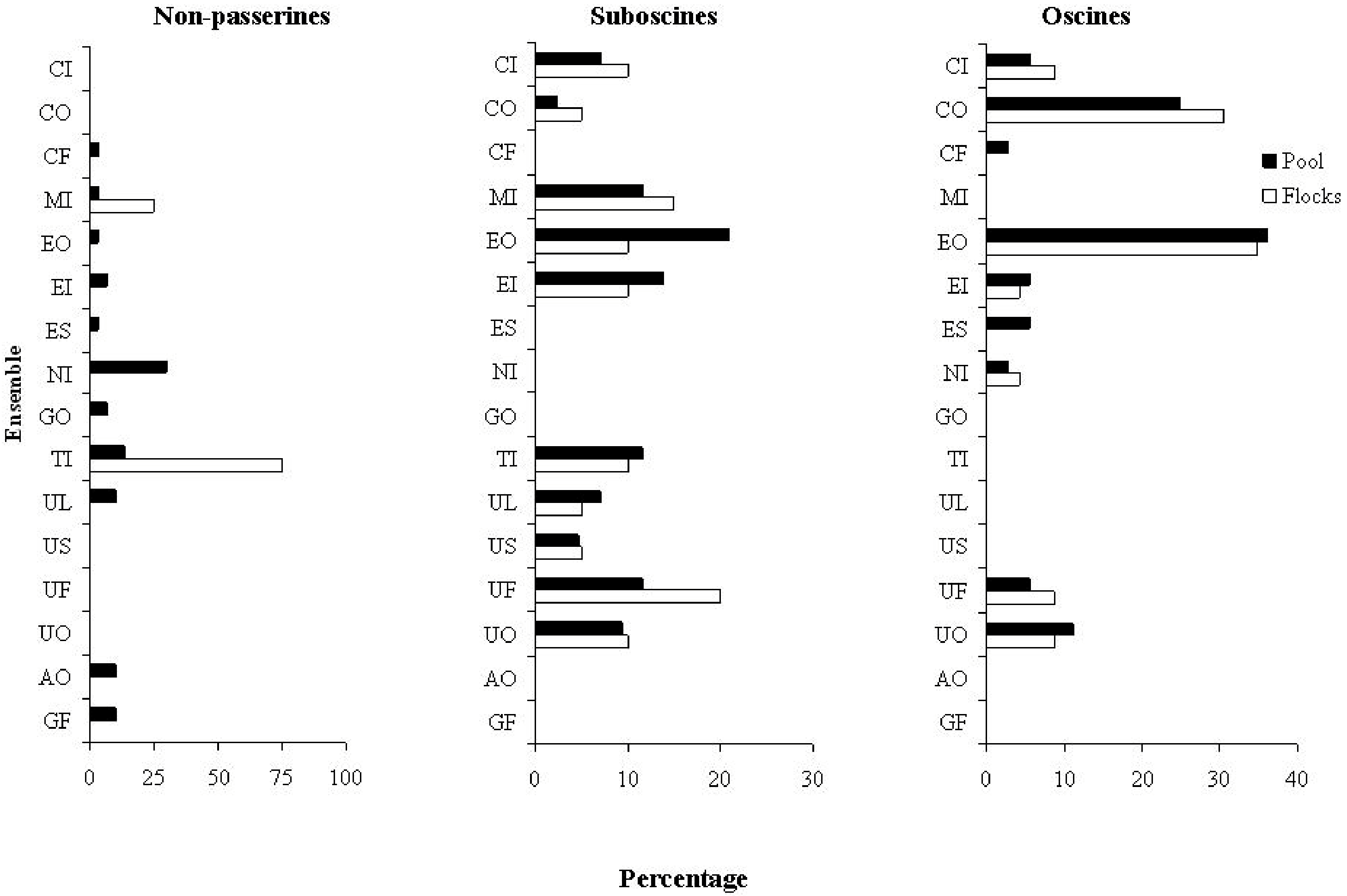
Reference	Study area	Forest type	Altitude (m)	Richness (% of local pool)	Mean number of species	Mean number of individuals
Davis (1946)	Fazenda Boa Fé, Rio de Janeiro	Montane	800	55	6.77	10
	Fazenda Comari, Rio de Janeiro	Montane	800	50	–	–
Stotz (1993)	Reserva Florestal Rio Doce, Espírito Santo	Lowland Semideciduous	50	82 (23.4)	9.77[a]	16.02[a]
Aleixo (1997)	Barreiro Rico, São Paulo	Montane Semideciduous	550	51 (54.2)	10.2	–
Machado (1999)	Serra de Paranapiacaba, São Paulo	Montane	950	120 (37.5)	6.71	17.26
Develey and Peres (2000)	Juréia-Itatins, São Paulo	Coastal lowland	20-250	72	6.6	–
Maldonado-Coelho and Marini (2000)	Belo Horizonte, Minas Gerais[b]	Dry	900	41	7.6	14.6
Maldonado-Coelho and	Zona da Mata, Minas Gerais	Montane	650?	78	–	–

Reference	Study area	Forest type	Altitude (m)	Richness (% of local pool)	Mean number of species	Mean number of individuals
Marini (2003)		Semideciduous				
Maldonado-Coelho and Marini (2004)	Zona da Mata, Minas Gerais[c]	Montane Semideciduous	650	68 (59.1)	12.4	20.3
Ghizoni-Jr. and Azevedo (2006)	Santa Catarina Island, Santa Catarina	Hillside	Sea level?	34	6.49	–
	Volta Velha Reserve, Santa Catarina	Coastal lowland	Sea level?	51	6.23	–
Faxinal (this study)	Torres, Rio Grande do Sul	Lowland Swampy	5-20	47 (43.1)	4.2	6.8

[a] Without *Thamnomanes caesius*.

[b] This study was made in forest fragments with different sizes. For comparison purposes, we selected the richness and size values of the 200 ha-fragment, wich was the more similar in size with our study area.

[c] 120 ha-fragment, dry season.


Non-passerines
Suboscines
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0
25
50
75
100
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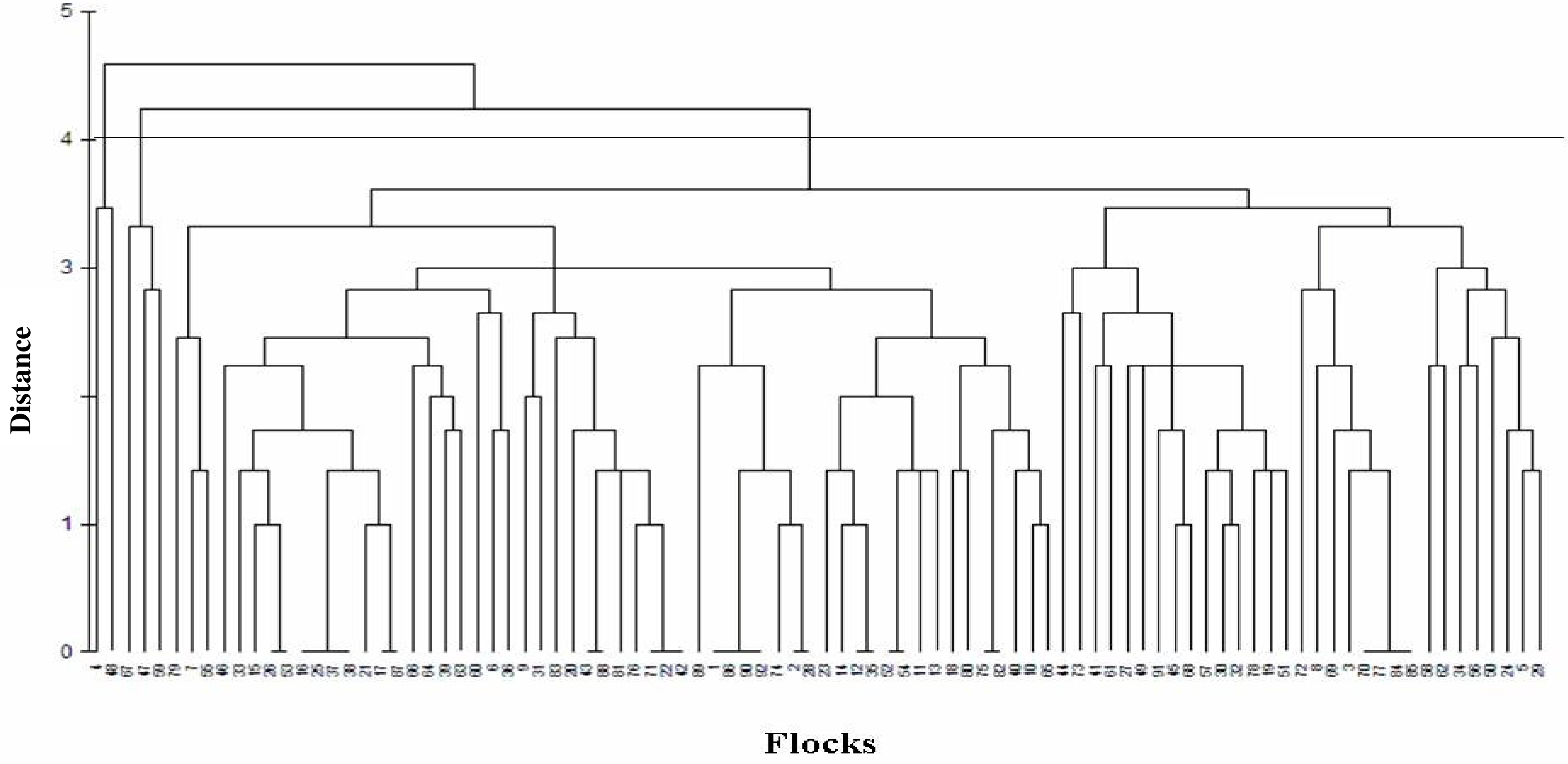
10
20
30
0
10
20
30
40
■ Pool
□ Flocks
Percentage

FIGURE 1. Percentual distribution of ensembles along the flocking species and the total pool the of three clades of birds in Faxinal, southern Brazil: (AO) aquatic omnivores, (CF) large canopy frugivores, (CI) canopy insectivores, (CO) small canopy omnivores, (EI) edge insectivores, (EO) edge omnivores, (ES) edge seedeaters, (GF) ground frugivores, (GO) grassland omnivores, (MI) midlevel insectivores, (NI) nectarivores-insectivores, (TI) trunk and twig insectivores, (UF) understory birds eating small foliage arthropods, (UL) understory birds eating large ground arthropods, (UO) understory omnivores, and (US) understory birds eating small ground arthropods.


5
4
3
1
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Distance
Flocks

FIGURE 2. Cluster dendrogram of similarity between all mixed-species flocks sampled in Faxinal, southern Brazil ($N = 92$). Horizontal line indicates significance partition at three groups (distance 4 in the distance axis).

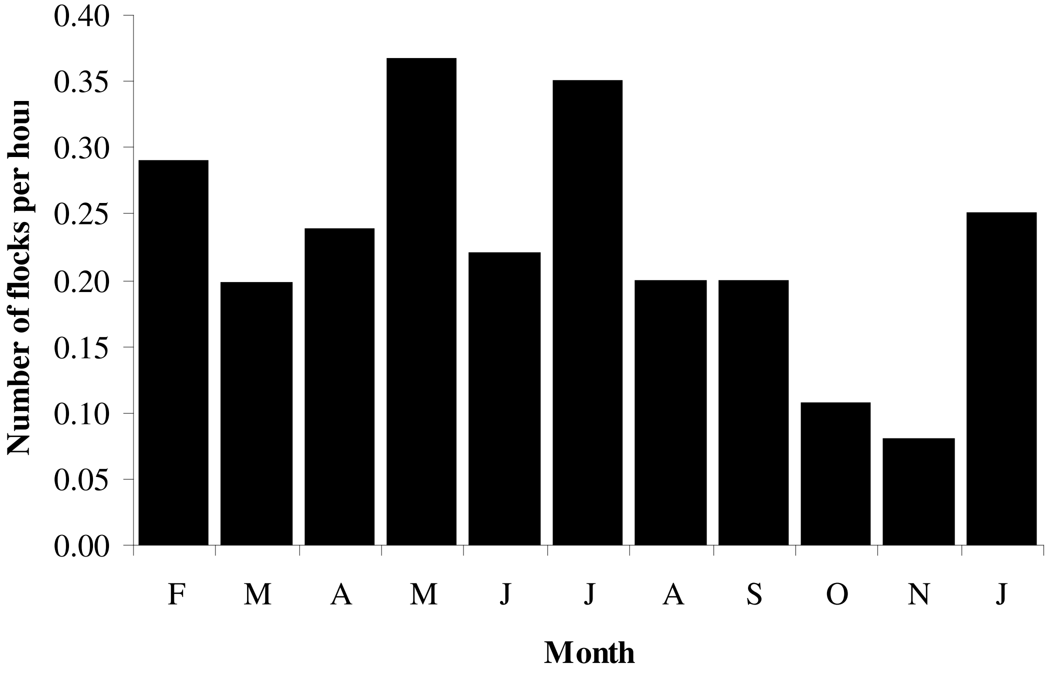

FIGURE 3. Monthly number of mixed-species flocks per hour of field work in Faxinal, southern Brazil, from February 2005 to January 2006, except December 2005.

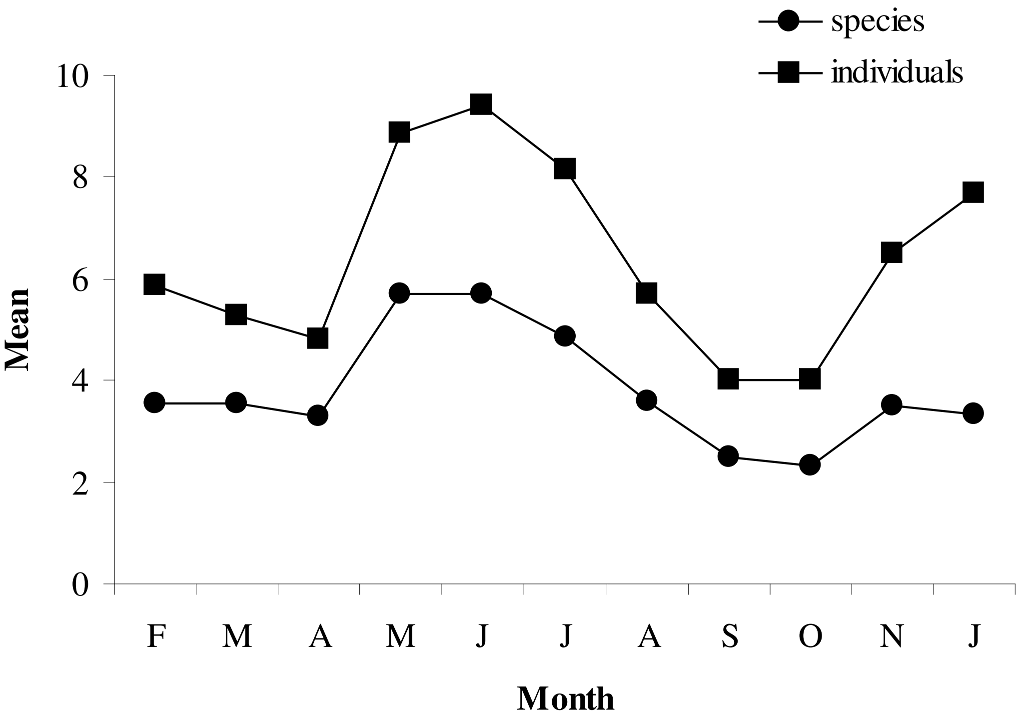

FIGURE 4. Monthly variation in mean numbers of species (richness) and individuals (flock size) of mixed-species flocks at Faxinal, southern Brazil, between February 2005-January 2006, except December 2005.

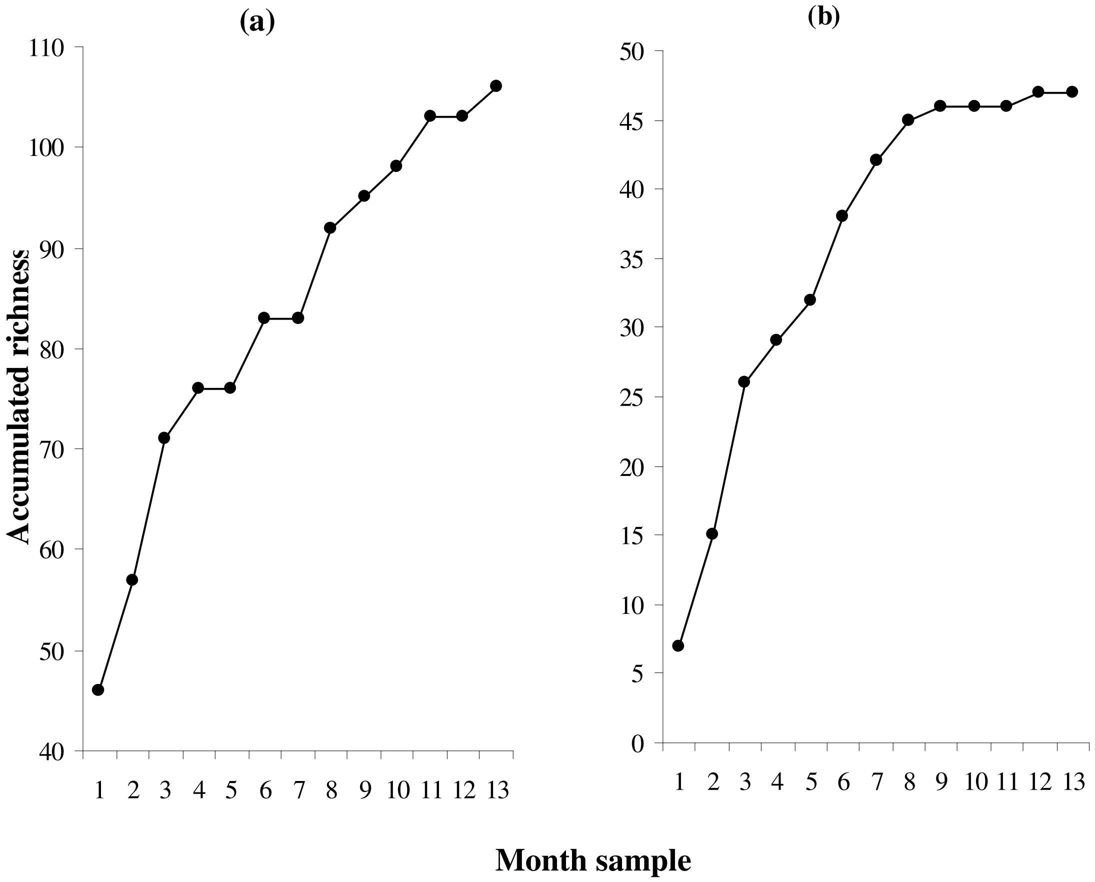

FIGURE 5. Curves of sample sufficiency (accumulated richness) for Faxinal bird assemblage (a) and for Faxinal mixed flocks participants (b). Monthly samples from September 2004 until January 2006. Not all the months in this interval were sampled.

CONSIDERAÇÕES FINAIS

Powell (1979) diferenciou entre causas próximas e causas remotas agindo no comportamento de integrar ou não bandos mistos. Entre as causas remotas estariam as pressões seletivas que moldaram este tipo de comportamento: distinguindo-se duas hipóteses principais: a de maximização do sucesso de forrageio e o incremento na evitação da predação. Se por um lado é difícil mensurar os determinantes remotos dos bandos mistos (necessariamente implicando em manipulação e experimentação), a mensuração das causas últimas é mais factível, e necessária para uma abordagem inicial e descritiva. A presente dissertação discorre essencialmente sobre as causas próximas, cuja identificação pode em última análise auxiliar na compreensão do significado adaptativo dos bandos mistos de aves.

Estudos apontam para os bandos mistos como um fenômeno ocorrente ao longo do ano todo nas regiões quentes do neotrópico (MUNN e TERBORGH 1979). Entretanto, variações sazonais foram detectadas em todos os sítios de Mata Atlântica onde este fenômeno foi estudado (DEVELEY 2001). Os resultados destes estudos sugerem fortemente que há uma influência das atividades reprodutivas na flutuação sazonal no tamanho dos bandos mistos, pelo menos em hábitats abertos e em florestas de altitudes e latitudes elevadas (DEVELEY e PERES 2000). Aparentemente, os bandos do Faxinal recordam o padrão até agora encontrado na Mata Atlântica, onde os bandos são maiores e mais ricos em espécies durante a estação não-reprodutiva. Investigações futuras relacionando estas alterações sazonais com possíveis modificações na disponibilidade de recursos alimentares, a exemplo do que foi efetuado por Develey e Peres (2000) em São Paulo, contribuiriam para a compreensão destes padrões no sul do Brasil.

Porém, para serem melhor compreendidos, estes padrões sazonais precisam ser averiguados em uma escala regional, sendo fundamental um estudo dos padrões de formação dos bandos mistos em outros hábitats florestais, representativos da região de planície costeira do sul do Brasil. Em um segundo momento, portanto, é fundamental a realização de estudos que busquem descrever os caracteres básicos dos bandos mistos florestais no Brasil meridional. Desta forma, projetos futuros visariam replicar o estudo realizado no Faxinal, e uma área de interesse para o campo seria a planície costeira do nordeste do Rio Grande do Sul e do sul de Santa Catarina, verificando a relação dos atributos dos bandos mistos com a latitude e a sazonalidade. Trabalhos adicionais em fragmentos de floresta paludosa no sul do País também podem auxiliar na compreensão da evolução e do impacto da fragmentação nos bandos mistos.

Os resultados aqui apresentados podem representar uma homogeneização da composição dos bandos mistos nos fragmentos de pequeno tamanho, tornando-os previsíveis em termos de espécies constituintes, em vista do “pool” reduzido. Se verdadeira e recorrente, tal constatação pode lançar luz sobre o controverso tema da evolução dos bandos mistos, unindo conceitos da biogeografia de ilhas, ecologia da paisagem e teoria dos refúgios.

Nestas considerações finais, também se pretende frisar a importância da integração entre a Etologia e a Biologia da Conservação (ANTHONY e BLUMSTEIN, 2000), em um claro exemplo de aliança entre Ciência básica e Ciência aplicada. Ao que tudo indica, os bandos mistos são um componente importante da história de vida de uma boa parcela da avifauna florestal neotropical, incluindo espécies ameaçadas de extinção e outras relacionadas com importantes processos ecológicos como a dispersão e a polinização. A interação acima citada entre as duas formas de fazer Ciência deve ser fomentada por todos os setores responsáveis, incluindo órgãos financiadores, educacionais e administradores do patrimônio natural. Nota-se também a importância de disponibilizar os resultados das pesquisas futuras a serem realizadas com as aves do Parque Estadual de Itapeva. Esta informação poderá gerar subsídios para o incremento do plano de manejo de Parque e a elaboração de atividades de sensibilização ambiental. Tal veiculação de resultados pode ocorrer tanto na forma de artigos publicados em periódicos científicos quanto na forma de textos direcionados ao público leigo, ficando a equipe do presente projeto comprometida com a pronta divulgação das análises e interpretações geradas a partir dos dados de campo.

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DEVELEY, P. F. Os bandos mistos de aves nas florestas neotropicais. In: ALBUQUERQUE, J. L. B.; CÂNDIDO Jr., J. F.; STRAUBE, F. C.; ROOS, A. L. (org.) **Ornitologia e conservação: da ciência as estratégias**. Tubarão: Editora da Universidade do Sul de Santa Catarina, 2001. p 39-47.

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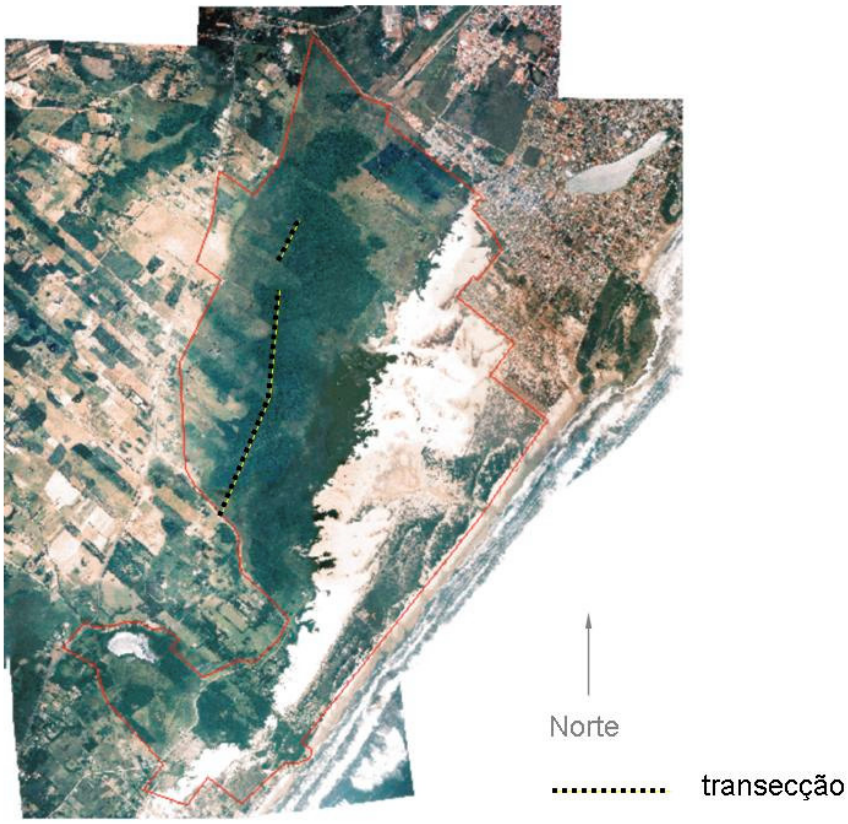
MUNN, C. A.; TERBORGH, J. W. Multi-species territoriality in neotropical foraging flocks. **Condor**, v. 81, p. 338-347, 1979.

POWELL, G. V. N. Structure and dynamics of interespecific flocks in a neotropical mid-elevation forest. **Auk**, v. 96, p. 375-390, 1979.

ANEXO 1. Imagem de satélite do Parque Estadual de Itapeva (PEVA, limites em vermelho), mostrando a transecção utilizada para acompanhamento dos bandos mistos e onde foram estabelecidos 15 pontos de contagem na mancha de floresta paludosa do Faxinal.



ANEXO 2. Instruções aos autores do periódico "The Condor" (extraído de http://www.cooper.org/pdf/instrucauth.pdf).

INSTRUCTIONS FOR AUTHORS

The Condor publishes original research reports and review articles pertaining to the biology of wild species of birds. Submit two paper copies of all materials, including text, tables, figures, and illustrations, to Dr. David S. Dobkin, Editor, *The Condor*, High Desert Ecological Research Institute, 15 S.W. Colorado Avenue, Suite 300, Bend, OR 97702, USA (telephone: 541-382-1117, e-mail: condor@hderi.org). Please DO NOT staple hardcopies. We encourage authors to submit a PDF version of their manuscript in addition to paper copies. Send PDF files on a CD, 3.5" floppy disk, (both MacIntosh and PC are acceptable), or zip disk. Be aware that in some software applications, some symbols do not convert to PDF, so proofread PDF files carefully before submitting.

A cover letter should accompany the manuscript. Authors should suggest names of three or four potential reviewers (including their postal and electronic addresses) for their manuscript, but the use of such reviewers is at the discretion of the Editor. In the cover letter, the author must indicate the extent to which the data have been used in other papers and reports that are published, in press, submitted elsewhere, or soon to be submitted. Please also provide an e-mail address for the corresponding author.

TYPES OF PAPERS

Manuscripts are published as Feature Articles, Short Communications, Commentaries, Book Reviews, or items for News and Notes. **Feature Articles** are longer manuscripts, whereas **Short Communications** are generally fewer than 10 typed pages (excluding Literature Cited) or deal with one primary finding. **Commentaries** are brief papers that comment on articles published previously in *The Condor*. Ornithological books are reviewed in the **Book Reviews** section. Interested book reviewers should contact Dr. David L. Swanson, Biology Department, University of South Dakota, Vermillion, SD 57069 (e-mail: dlswanso@usd.edu). **News and Notes** is devoted to noncommercial ornithological news. Contributors of announcements and requests for assistance should note that the *Ornithological Newsletter*, edited by Dr. Cheryl L. Trine, 3889 Valley View, Berrien Springs, MI 49103 (e-mail: ctrine@andrews.edu), is published more frequently and more quickly than *The Condor*.

FORMAT FOR SUBMITTED MATERIAL

GENERAL GUIDELINES

Authors should read these instructions carefully *before* preparing a manuscript for submission. Papers that are not in *Condor* format will be returned.

1. Double-space and left-justify the entire manuscript, including the title page, text, literature cited, figure legends, and tables. Use the same size font (at least 12 point) throughout the manuscript. Provide at least 3-cm margins and use only one side of standard (8.5 × 11 inch) or A4 (21 × 30 cm) paper. If your word processing program permits, please number every other line of text.

2. Make sure that all figures meet the specifications given under “FIGURES.”

3. Put the first author’s name in the upper right-hand corner of every page. Number text pages beginning with the Abstract through the list of references. Avoid footnotes in the text.

4. Write in the active voice and use U.S. English and spelling throughout the manuscript, except for foreign literature citations.

5. Use *real italics* not underlines, and real superscripts and subscripts, not raised or lowered characters. Use normal font, not bold.

6. Give the scientific name in parentheses at the first mention of a species, both in the abstract and in the article. Scientific and English names of birds should follow the *AOU Checklist of North American Birds* (7th ed., 1998; and supplements published in *Auk*) or an authoritative source for other regions. Do not give subspecific identification unless it is pertinent and has been critically determined. Capitalize common names of bird species (e.g., Red-winged Blackbird), but not bird groups (e.g., blackbirds), throughout the manuscript. This rule includes all references, figures, and tables.

7. Minimize use of nonstandard abbreviations or acronyms that readers must memorize in order to follow your paper.

MANUSCRIPT

Correct sequence for sections of a submitted manuscript is Title page, Abstract, Key words, Introduction, Methods, Results, Discussion, Acknowledgments, Literature Cited, Figure legends, Figures, and Tables. Indent each new paragraph (use 0.5-inch tabs), except the first paragraph that follows a heading. Each main heading is capitalized (INTRODUCTION, METHODS, RESULTS, DISCUSSION, ACKNOWLEDGMENTS, LITERATURE CITED). Second-order headings are also capitalized and appear on their own line. Third-order headings are italicized, followed by a period, and set in to the first line of the paragraph. Like other paragraphs, third-order headings are indented unless they follow a main or second-order heading (see examples in recent issues and these instructions).

Title page. Place the title, all authors' names, affiliations and addresses, and the e-mail address of the corresponding author on the title page. Provide an abridged title shorter than 60 characters in the upper portion of the same sheet. Current addresses not given above should be given as footnotes in the lower portion of the title page. Titles usually do NOT include scientific names of species. Start the *Abstract* on the next page.

Abstract. Feature Articles, Short Communications, and Commentaries should have an abstract that informs readers of essential points in the text. The abstract should be concise, informative, and intelligible without reference to the article itself. Avoid statistical information in the abstract. Abstracts are to be shorter than 250 words for Feature Articles and shorter than 150 words for Short Communications and Commentaries. Indent and italicize the word *Abstract*; the first sentence of the *Abstract* follows immediately. Authors are encouraged to provide a technically competent Spanish translation of the title and abstract if possible. This abstract is in addition to the English version and does not substitute for it.

Key words: The term *Key words*: is indented and in italics, followed by up to seven key words in alphabetical order. The key words are also in italics, except for genus and species, which are in roman (normal) type.

Introduction. The *Introduction* begins on a new page; it should provide the aims and significance of the research and place it within the framework of existing work. Limit the use of citations; in general there are few points that cannot be supported by three or fewer references. Long lists of citations are seldom required and detract from the readability of the manuscript. Avoid parenthetical phrases and “i.e.,” “e.g.,” “cf.,” and “see….”

Methods. This section should provide enough information for the reader to be able to replicate and critically evaluate the research. The *Methods* should contain a subsection (STATISTICAL ANALYSES) describing the statistical tests and procedures used. Cite statistical software and any other analysis programs (e.g., Avisoft, DISTANCE, Paup*) here and in the *Literature Cited.* End this subsection with a statement to the effect that the values reported in the *Results* section are means ± SE (or SD). Then in the *Results* section, simply present the values. Indicate the significance level of statistical tests. If reporting the results of analyses using the information-theoretic method, describe and justify the a priori hypotheses and models in the candidate set, identify exploratory analyses, and state here the criterion used to evaluate models, e.g., 2nd order AIC corrected for small sample sizes (AIC_c), AIC differences (Δ_i), and Akaike weights (w_i). In general, follow the suggestions of Anderson et al. (2001), Suggestions for presenting the results of data analyses, Journal of Wildlife Management 65:373–378.

Results. The *Results* section should include only results pertinent to the hypotheses or questions raised in the *Introduction* and treated in the *Discussion*. Use the same number of decimal places for means and SE or SD (e.g., 38.9 ± 1.2, not 38.9 ± 1.23); usually only one or two decimal places are necessary. Round off percentages to whole numbers. The text should not duplicate material presented in tables or figures. The text should make clear the relevant sample sizes, degrees of freedom, values of statistical tests, and *P*-values. Test statistics should be rounded to one (*t*-test, χ_2, *F*, etc.) or two (*r*, r_2, etc.) decimal places. When reporting the results of AIC analyses, please follow the advice of Anderson et al. (2001; as above), except only report the lowest AIC (or AIC_c, $QAIC_c$) value—see recent issues for examples.

Discussion. It is useful to start the *Discussion* with a statement that summarizes the main results. The *Discussion* should develop the significance and importance of the results and set them into a framework of previous research. The discussion should follow logically from the results. Additional statistical tests and results are usually inappropriate here and should be treated in the *Results* section, except in unusual cases. In general, do not parenthetically cite Figures or Tables in the *Discussion* that have already been cited elsewhere in the paper.

Literature Cited. Cite references in the text as, for example, Darwin and Huxley (1993), or in parentheses as (Darwin and Huxley 1993). Do not use commas between author and year; do use a comma, and never a semicolon, between different citations by the same or different authors. List multiple citations in chronological order and use lowercase letters to indicate separate papers by the same author in the same year, e.g., (Zar 1973, Giles 1994a, 1994b). For citations with three or more authors, give the first author's surname followed by "et al." and then the date, e.g., (Schmuckvogel et al. 1999).

Cite references in the *Literature Cited* section in alphabetical order according to the authors' surnames. Do not abbreviate names of publications. Type references in upper and lower case (including all authors' names) in the following form:

Ankney, C. D., and R. T. Alisauskas. 1991. The use of nutrients by breeding waterfowl. Proceedings of the International Ornithological Congress 20:2170–2176.

Fraga, R. M. 1986. The Bay-winged Cowbird (*Molothrus badius*) and its brood parasites: interactions, coevolution, and comparative efficiency. Ph.D. dissertation, University of California, Santa Barbara, CA.

Nolan, V., Jr. 1978. The ecology and behavior of the Prairie Warbler *Dendroica discolor*. Ornithological Monographs 26.

Ralph, C. J., G. L. Hunt Jr., M. G. Raphael, and J. F. Piatt [eds.]. 1995. Ecology and conservation of the Marbled Murrelet. USDA Forest Service General Technical Report PSW-GTR-152.

Rappole, J., and D. Warner. 1980. Ecological aspects of migrant bird behavior in Veracruz, Mexico, p. 353–393. *In* A. Keast and E. S. Morton [eds.], Migrant birds in the Neotropics: ecology, behavior, distribution, and conservation. Smithsonian Institution Press, Washington, DC.

SAS Institute. 1990. SAS/STAT user's guide. Version 6, 4th ed. SAS Institute Inc., Cary, NC.

Cite papers in proceedings from international ornithological congresses, *Current Ornithology*, and *Studies in Avian Biology* as journal articles rather than edited volumes. Spell out journal names and institutions completely. Cite Internet resources only if they are important, reasonably permanent, and not readily available in print. Include the date you last accessed the website and use the following format:

Shipman, J. W. [online]. 2000. The Christmas Bird Count database project. <http://www.nmt.edu/~shipman/z/cbc/homepage.html> (15 March 2004).

FIGURES

Figures should be simple and easily comprehended without reference to the manuscript. All figures should use the same style of lettering (in a sans serif font such as Arial or Tahoma) and presentation, with details and text made large enough to allow for reduction; figures are generally reduced to fit one column (7 cm wide) of the journal. Figures will be published directly from the submitted material and MUST meet the following specifications:

1. Halftone and color images should be scanned at a MINIMUM of 300 pixels per inch (dpi). Line art should be scanned at 1200 dpi. Note that nearly all images that are in JPEG or GIF format will be 72 dpi and not acceptable for the printing process.
2. Figures should be submitted in TIFF, Adobe Photoshop (.psd), Adobe Acrobat (.pdf—use the Press setting under Job Option), PowerPoint (.ppt), or Word (.doc) format.

Figures must be monochrome unless the author has funds to support color printing. Do not use three-dimensional graphs or odd fills. Preferred shadings are black, white, and crosshatching. Preferred point symbols are circles, squares, and triangles. Give keys and other explanations either in the figure legend or on the figure itself; however, symbols themselves should *not* appear in the legend. Do not describe unfilled symbols as "open."

Legends for all figures should be typed on a separate sheet labeled "Figure Legends." Number the figures in the order they appear in the text (e.g., FIGURE 1, FIGURE 2, etc.). Figure legends should not repeat information already mentioned in the text or in tables.

Illustrations should be submitted either as original artwork/photographs or digital images. Hardcopies must be no larger than 21 × 28 cm (8.5 × 11 inches). Digital images must meet the specifications outlined above. Each figure or illustration should have the authors' names and figure number (e.g., Fig. 1) written lightly in pencil (not pen) either in a corner or on the back.

For sound spectrograms (sonograms), use the actual tracing if it is sharp, clear and relatively short. If intensity differences are not important, then submit a high-contrast photograph or scan that meets the above specifications. Make sure all axes are labeled. All figures will be destroyed after publication unless we are otherwise notified by the author.

TABLES

Keep tables as simple as possible. They should be intelligible without reference to the manuscript and should not restate results given in the text. Each table should begin on a separate, unnumbered page, and should be numbered with an Arabic numeral in the same order as it appears in the text (i.e., TABLE 1, TABLE 2, etc.). Do not use vertical lines in the table; use horizontal lines for the main heading and the end of the table, but *not* in the body of the table. The table must be typed in 12-point font and double-spaced throughout, including caption and footnotes (if necessary, use more than one sheet of paper for a table). Do not include extensive raw tabular material either as tables or appendices. Such data can be made available to interested readers by request from the author or posted on the author's web site. If birds are listed in several tables included with the manuscript, Latin names should be given only in the table with the comprehensive species list.

TIME AND DATE

Use the 24-hour clock and retain the colon (18:30, 07:00). Times should be reported as local time together with appropriate time zone. Give dates as day month year (20 September 1968) and year ranges as 1989–1991, not 1989–91. Abbreviate seconds (sec), minutes (min) and hours (hr), but not day, week, month, or year. Names of months may be abbreviated in figures or long tables.

NUMERALS

Spell out numbers less than 10, except for measurements, such as 5 km (but nine blackbirds). Hours, minutes, and seconds are units of measurement. Use metric measurements throughout. There are neither a comma nor a space in numbers less than 10 000 (e.g., 1232 larks). In numbers greater than 9999, separate the hundreds and thousands places using a space, e.g., 22 432 murres. Precede decimal fractions by a zero, (0.97, not .97). Round percentages to the nearest whole number (57%, not 57.3%; <1%, not 0.3 or 0.8%), unless there is some compelling reason not to do so. Do not use slant lines in expressions of units; instead, use exponential form or the word *per* throughout text, tables, and figures (e.g., use kJ day^{-1}, not kJ/day).

STATISTICAL FORMAT

Follow *Condor* format for statistical indices, including capitalization, italics, superscripts, and subscripts. The following are *in italics*:

n (sample size, lowercase)

P (probability rounded to two decimal places, unless P < 0.01, in which case reduce to three decimal places; use $P < 0.001$ as the smallest P-value). Examples:

If $P = 0.019$, report as $P = 0.02$

If $P = 0.003$, report as $P = 0.003$

If $P = 0.564$, report as $P = 0.56$

t_a (t-test, with subscript a = degrees of freedom; specify independent or paired t-test and two-tailed or one-tailed test in *Methods: Statistical Analyses*)

$F_{a,b}$ (F-ratio, with subscripts a,b = appropriate degrees of freedom)

U (Mann-Whitney U-test)

r (simple correlation coefficient; Pearson r)

z (Wilcoxon test)

r_s (Spearman rank-order correlation)

R (multiple regression coefficient)

G (G-test)

K (number of parameters in AIC analyses)

The following statistical information is set in normal font, not italics:

SD (standard deviation)

SE (standard error)

χ^{2}_{a} (chi-square, where subscript a = degrees of freedom)

CV (coefficient of variation)

df (degrees of freedom)

AIC_{c} (note that the subscript *c* is italicized)

Note that all variables are italicized, unless they are denoted by a Greek letter in which case they are not italicized.

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Revisions of tentatively accepted manuscripts must be completed and returned to the Editor within 75 days. Manuscripts returned beyond that time likely will be treated as new submissions. **Authors of accepted manuscripts are invited to submit sharp photographs or slides for use as cover illustrations for *The Condor*.**

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Proofs and reprint order forms ordinarily will be sent to the first author. Please inform the editorial office well in advance of any change in address or alternate system for handling proofs. Check proofs carefully for errors. Author-related changes will be charged to the author at $3.50 per change. **Please send any proof changes via e-mail (preferred) or courier, within 48 hours to *The Condor*, High Desert Ecological Research Institute, 15 S.W. Colorado Ave., Bend, OR 97702 (condor@hderi.org).**

ANEXO 3. Dados de 92 bandos mistos na floresta palud osa do Faxinal, Torres, Rio Grande do Sul, Brasil.

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
1	18.set.2004	2	11:15'	11:22’	7		6 Habirubi, 2 Philatri	2	8
2	10.out.2004	11	08:06'	08:14'	8		2 Habirubi, 2 Myrmunic, 1 Philatri	3	5
3	18.out.2004	48	10:40'	10:54'	14		2 Phylvent, 1 Coerflav, 1 Parupiti, 1 Xenoruti	5	5
4	29.I.2005	20	08:00'	08:20'	20		3 Ictecaya, 4 Tachcoro, 2 Saltsimi, 2 Thrasaya, 3 Celeflav, 1 Dacncaya, 1 Empivari, 1 Turdamau, 1 Coerflav, 1 Euphonia sp.	10	19
5	01.fev.2005	81	13:40'	14:00'	20	29	3 Phylkron, 2 Basiculi, 1	3	6

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Picutemm		
6	03.fev.2005	14	07:50'	08:05'	15		3 Parupiti, 2 Coerflav, 2 Basiculi, 1 Hemithraupis sp., 1 Tachcoro, 1 Thracyan	6	10
7	03.fev.2005	29	09:20'	09:55'	35		3 Habirubi, 2 Myrmunic, 1 Platmyst, 2 Basiculi, 2 Tachcoro	5	10
8	03.fev.2005	45	10:45'	10:51'	5		2 Parupiti, 2 Phylvent, 3 Piprmela, 1 Pachpoly	4	8
9	03.fev.2005	59	12:0'	12:14'	14	23	1 Dacncaya, 1 Tangara sp.	2	2
10	03.fev.2005	82	13:29'	13:35'	5	22	2 Platmyst, 2 Myrmunic, 1	3	5

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Thamcaer		
11	03.fev.2005	93	13:55'	14:15'	20	22	2 Myrmunic, 1 Phylvent, 2 Basiculi, 1 Picutemm, 1 Thamcaer	5	7
12	03.fev.2005	123	14:40'	14:47'	7		2 Myrmunic, 1 Picutemm	2	3
13	03.fev.2005	145	15:23’	15:51’	18		1 Syndrufo, 1 Picutemm, 1 Basiculi, 2 Myrmunic, 2 Thamcaer	5	7
14	03.fev.2005	170	16:04'	16:10'	5	23	1 Picutemm, 2 Myrmunic, 2 Parupiti.	3	5
15	08.fev.2005	169	10:26'	10:32'	5		1 Picutemm, 2 Myrmunic, 2 Basiculi	3	5

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
16	11.fev.2005	215	15:36'	15:58'	22	24	2 Habirubi, 2 Basiculi	2	4
17	12.fev.2005	214	09:20'	09:25’	5		2 Habirubi, 1 Basiculi, 1 Myrmunic	3	4
18	04.mar.2005	24	08:34'	08:45'	11	20	2 Thamcaer, 3 Tachcoro, 2 Myrmunic, 1 Parupiti, 1 Coerflav	5	9
19	04.mar.2005	30	09:10'	09:25'	15	21	2 Myrmunic, 1 Basiculi, 1 Tangara sp., 1 Thamcaer	4	5
20	04.mar.2005	60	10:30'	10:36'	5	27	1 Phylkron, 1 Hemithraupis sp.	2	2
21	04.mar.2005	127	16:35'	16:41'	5	26	3 Habirubi, 1 Chircaud, 1 Basiculi, 2 Myrmunic	4	7

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
22	05.mar.2005	117	09:17'	09:23"	5		1 Phylkron, 1 Parupiti	2	2
23	05.mar.2005	104	10:30'	10:37'	7	25	1 Myrmunic, 1 Platmyst, 1 Picutemm	3	3
24	07.mar.2005	145	08:10'	08:30'	20	21	1 Parupiti, 1 Phylkron, 1 Euphpect, 2 Picutemm, 1 Basiculi, 1 Myrmunic	6	7
25	07.mar.2005	223	18:00'	18:06'	5		4 Habirubi, 1 Basiculi	2	5
26	08.mar.2005	78	17:00'	17:05'	5		1 Myrmunic, 1 Basiculi	2	2
27	08.mar.2005	64	17:30'	17:36'	6		3 Habirubi, 1 Platmyst, 2 Basiculi, 2 Myrmunic, 1 Thamcaer, 1 Campobso	6	10
28	11.mar.2005	217	10:20'	10:35'	15	25	3 Habirubi, 2 Myrmunic, 1	3	6

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Philatri		
29	04.abr.2005	38	09:19'	09:25'	6	19	2 Phylkron, 1 Picutemm, 1 Euphpect	3	4
30	04.abr.2005	40	09:30'	09:47'	17	19	3 Myrmunic, 2 Basiculi, 2 Thamcaer, 1 Parupiti	4	8
31	04.abr.2005	50	10:22'	10:28’	6	20	1 Dacncaya, 2 Tachcoro, 1 Cnemfusc, 1 Thrasaya	4	5
32	04.abr.2005	120	14:20'	14:25’	5	22	1 Parupiti, 2 Basiculi, 2 Myrmunic	3	5
33	04.abr.2005	150	16:30'	16:45'	15	23	2 Myrmunic, 2 Phylkron, 1 Basiculi	3	5
34	07.abr.2005	120	10:50'	10:55'	5	26	1 Parupiti, 1 Phylkron, 1	5	5

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Euphpect, 1Thamcaer, 1 Trogmusc		
35	07.abr.2005	170	14:00'	14:08'	8	28	2 Myrmunic. 1 Picutemm	2	3
36	07.abr.2005	237	16:30'	16:40'	10	28	2 Phylkron, 2 Coerflav, Tachcoro, 2 Basiculi, 1 Parupiti	5	8
37	07.abr.2005	212	17:42'	17:50'	12	25	3 Habirubi, 1 Basiculi	2	4
38	09.abr.2005	36	13:00'	13:05'	5		2 Habirubi, 1 Basiculi	2	3
39	10.abr.2005	226	10:10'	10:15'	5	23	1 Basiculi, 1 Coerflav, 1 Turdrufi	3	3
40	08.mai.2005	Ppatrick	08:40'	08:47'	7	21	4 Myrmunic, 1 Thamcaer, 1 Phylkron	3	6

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
41	10.mai.2005	24	12:15'	12:45'	30	24	3 Piaycaya, 1 Dendplat, 1 Coerflav, 3 Habirubi, 1 Basiculi, 1 Thamcaer	6	10
42	10.mai.2005	45	13:50'	13:56'	5	22	2 Phylkron, 2 Parupiti	2	4
43	10.mai.2005	79	15:05'	15:12'	7	23	2 Phylkron, 2 Myrmunic, 1 Parupiti	3	5
44	10.mai.2005	45	16:48'	17:00'	12	22	4 Habirubi, 2 Parupiti, 1 Saltsimi, 1 Phylloscartes sp, 1 Coerflav, 1 Chircaud, 1 Thamcaer, 1 Basiculi, 1 Euphpect	9	13
45	11.mai.2005	69	08:07'	08:17'	10	17	4 Habirubi, 1 Euphpect, 1	7	12

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Parupiti, 1 Thamcaer, 1 Phylkron, 1 Basiculi, 3 Myrmunic		
46	14.mai.2005	215	11:05'	11:35'	30	23	3 Myrmunic, 2 Basiculi, 1 Schivire, 1 Coerflav, 1 Xenoruti	5	8
47	14.mai.2005	205	11:38	11:50'	12	24	1 Tachcoro, 1 Chircaud, 1 Thamcaer, 1 Campobso, 1 Turdrufi, 2 Euphpect, 1 Basiculi, 1 Synaspix	8	9
48	15.mai.2005	44	10:00'	10:13'	13	23	1 Thrasaya, 1 Coerflav, 1 Phylkron, 1 Leptamau, 1	10	11

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Tachcoro, 1 Parupiti, 1 Thamcaer, 2 Myrmunic, 1 Dacncaya, Tyrannidae ni		
49	15.mai.2005	77	11:20'	11:40'	20	23	3 Habirubi, 1 Basiculi, 1 Thamcaer, 2 Myrmunic, 2 Parupiti, 2 Thrasaya, 1 Tangara sp.	7	12
50	15.mai.2005	88	12:00'	12:10'	10	23	2 Parupiti, 1 Euphpect, 1 Cyclguja, 1 Pícutemm, 4 Basiculi, 4 Habirubi, 1 Piaycaya	7	14
51	15.mai.2005	99	12:40'	12:47'	7	23	2 Basiculi, 2 Thamcaer	2	4

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
52	15.mai.2005	189	16:20'	16:33'	13	24	2 Basiculi, 2 Myrmunic, 1 Thamcaer, 1 Picutemm, 1 Xenoruti	5	7
53	07.jun.2005	Ppatrick	09:10'	09:15'	5	17	2 Basiculi, 1 Myrmunic	2	3
54	07.jun.2005	215	10:50'	11:15'	25	22	2 Myrmunic, 2 Basiculi, 1 Picutemm, 1 Thamcaer, 1 Xenoruti	5	7
55	08.jun.2005	217	10:50'	11:15'	25	19	2 Myrmunic, 2 Basiculi, 6 Habirubi, 3 Picutemm, 2 Tachcoro, 1 Xenops, 1 Platmyst	7	17
56	10.jun.2005	190	14:10'	14:20'	10	21	2 Basiculi, 1 Parupiti, 2	8	13

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Thamcaer, 3 Myrmunic, 1 Conoline, 2 Phylkron, 1 Piaycaya, 1 Euphpect		
57	10.jun.2005	195	14:30'	14:40'	10	21	2 Basiculi, 1 Parupiti, 2 Thamcaer, 3 Myrmunic, 1 Geotaequ	5	9
58	11.jun.2005	69	08:33'	08:43'	10	22	1 Parupiti, 1 Tangara sp., 1 Coerflav, 2 Euphpect, 2 Basiculi, 1 Tolmsulp, 1 Emberizidae ni	7	9
59	11.jun.2005	8	12:50'	13:00'	10	23	1 Saltsimi, 1 Chircaud, 2 Thrasaya, 1 Turdalbi, 1	6	8

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Thamcaer, 2 Tachcoro		
60	13.jul.2005	20	08:55'	09:05'	10	17	2 Thracyan, 1 Hemithraupis sp., 2 Euphcyan, 1 Coerflav	4	6
61	13.jul.2005	20	08:55'	09:05'	10	17	4 Habirubi, 1 Thamcaer, 2 Basiculi, 1 Cyclguja, 1 Saltsimi	5	9
62	13.jul.2005	30	10:00'	10:10'	10	17	2 Phylkron, 2 Parupiti, 2 Basiculi, 1 Tolmsulp, 1 Coerflav,, 1 Thamcaer	6	9
63	13.jul.2005	65	11:30'	11:36'	5	21	2 Basiculi, 1 Geotaequ	2	3
64	13.jul.2005	122	14:00'	14:06'	5	21	2 Basiculi, 2 Phylvent, 1 Thamcaer, 1 Coerflav	4	6

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
65	13.jul.2005	173	16:33'	16:45'	12	20	2 Myrmunic, 1 Thamcaer	2	3
66	13.jul.2005	195	17:10'	17:20'	10	19	2 Platmyst, 2 Basiculi, 2 Conoline	3	6
67	14.jul.2005	43	08:05'	08:14'	9	11	2 Basiculi, 1 Parupiti, 1 Turdrufi, 2 Thrasaya, 1 Thamcaer, 1 Xenoruti, 1 Campobso, 2 Phylvent, 1 Cyclguja, 4 Habirubi, 1 Chircaud, 1 Euphchlor, 1 Turdalbi	13	19
68	14.jul.2005	69	08:32'	08:38'	5	13	5 Habirubi, 1 Euphpect, 2 Basiculi, 2 Phylkron, 2	6	14

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
69	14.jul.2005	70	11:50'	12:00'	10	20	Thamcaer, 2 Myrmunic 2 Phylkron, 2 Parupiti, 1 Coerflav, 2 Phylvent, 1 Euphonia sp.	5	8
70	15.jul.2005	163	13:10'	13:23'	13	21	2 Parupiti, 2 Coerflav	2	4
71	18.jul.2005	153	11:10	11:19'	9	15	2 Parupiti, 2 Phylkron	2	4
72	18.jul.2005	99	14:50'	15:10'	20	16	1 Xenoruti, 2 Parupiti, 2 Phylvent, 1 Chircaud, 1 Dacncaya, 2 Phylkron, 2 Basiculi, 1 Piaycaya	8	12
73	19.jul.2005	Pcecropia	07:34'	07:44'	10	4	4 Habirubi, 2 Phylkron, 2 Basiculi, 1 Chircaud, 1	6	11

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Turdamau, 1 Saltsimi		
74	12.ago.2005	58	11:12'	11:20'	8	16	4 Habirubi, 2 Myrmunic	2	6
75	12.ago.2005	125	14:20'	14:26'	6	19	1 Phylvent, 2 Myrmunic	2	3
76	12.ago.2005	167	16:20'	16:25'	5	16	2 Parupiti, 1 Coerflav, 1 Phylkron	3	4
77	13.ago.2005	144	08:45'	09:00'	15	16	1 Parupiti, 1 Coerflav	2	2
78	14.ago.2005	70	11:17'	11:23'	5	19	2 Myrmunic, 2 Thamcaer, 2 Basiculi, 1 Venispil	4	7
79	15.ago.2005	122	13:51'	14:05'	14	24	2 Myrmunic, 2 Basiculi, 1 Picutemm, 1 Geotaequ, 2 Saltsimi, 2 Tachcoro, 1 Coerflav	7	11

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
80	15.ago.2005	115	14:20'	14:36'	16	25	2 Myrmunic, 1 Piprmela, 2 Tahcoro, 1 Thamcaer, 1 Parupiti	5	7
81	09.set.2005	210	11:20	11:26'	5	20	2 Parupiti, 2 Basiculi, 1 Phylkron	3	5
82	13.set.2005	118	09:10'	09:16'	5	13	1 Myrmunic, 1 Phylvent	2	2
83	14.set.2005	Pcapoeira	07:45'	07:51'	5	13	2 Trogaedo, 2 Synaspix, 2 Geotaequ	3	6
84	16.set.2005	160	10:20'	10:26'	5	16	2 Parupiti, 1 Coerflav	2	3
85	30.out.2005	144	08:18'	08:30'	12	21	1 Coerflav, 1 Parupiti	2	2
86	31.out.2005	48	06:25'	06:35'	10	15	2 Habirubi, 1 Philatri	2	3
87	31.out.2005	99	07:40'	07:50'	10	18	3 Habirubi, 2 Myrmunic, 2	3	7

Nº	Data	Ponto	Horário inicial	Horário final	Tempo (min)	Temperatura	Integrantes[a]	Número de espécies	Número de indivíduos
							Basiculi		
88	16.nov.2005	99	12:16'	12:21'	5		1 Phylkron, 2 Parupiti, 2 Myrmunic	3	5
89	21.nov.2005	70	07:18'	07:30'	12		4 Habirubi, 2 Myrmunic, 1 Phylkron, 1 Vireoliv	4	8
90	03.jan.2006	5	07:15'	07:20'	5		4 Habirubi, 1 Philatri	2	5
91	04.jan.2006	48	06:35'	06:40'	5		6 Habirubi, 1 Thamcaer, 1 Phylkron, 2 Myrmunic, 2 Basiculi, 1 Philatri	6	13
90	04.jan.2006	217	08:08'	08:13'	5		4 Habirubi, 1 Philatri	2	5

[a] Basiculi = *Basileuterus culicivorus*, Campobso = *Camptostoma obsoletum*, Chircaud = *Chiroxiphia caudata*, Celeflav = *Celeus flavescens*, Cnemfusc = *Cnemotriccus fuscatus*, Coerflav = *Coereba flaveola*, Conoline = *Conopophaga lineata*, Cyclguja = *Cyclarhis gujanensis*, Dacncaya

= *Dacnis cayana*, Dendplat = *Dendrocolaptes platyrostris*, Empivari = *Empidonomus varius*, Euphchlo = *Euphonia chlorotica*, Euphcyan = *Euphonia cyanocephala*, Euphpect = *Euphonia pectoralis*, Geotaequ = *Geothlypis aequinoctialis*, Habirubi = *Habia rubica*, Hemirufi = *Hemithraupis ruficapilla*, Ictecaya = *Icterus cayanensis*, Leptamau = *Leptopogon amaurocephalus*, Myrmunic = *Myrmotherula unicolor*, Pachypoly = *Pachyramphus polychopterus*, Parupity = *Parula pitiayumi*, Piaycaya = *Piaya cayana*, Picutemm = *Picumnus temminckii*, Phylkron = *Phylloscartes kronei*, Phylvent = *Phylloscartes ventralis*, Philatri = *Philydor atricapillus*, Piprmela = *Pipraeidea melanonota*, Platmyst = *Platyrinchus mystaceus*, Saltsimi = *Saltator similis*, Schivire = *Schiffornis virescens*, Synaspix = *Synallaxis spixi*, Syndrufo = *Syndactyla rufosuperciliata*, Tachycoro = *Tachyphonus coronatus*, Thamcaer = *Thamnophilus caerulescens*, Thamrufi = *Thamnophilus ruficapillus*, Thrasaya = *Thraupis sayaca*, Thracyan = *Thraupis cyanoptera*, Tolmsulp = *Tolmomyias sulphurescens*, Trogmusc = *Troglodytes musculus*, Turdalbi = *Turdus albicollis*, Turdamau = *Turdus amaurochalinus*, Turdrufi = *Turdus rufiventris*, Venispil = *Veniliornis spilogaster*, Vireoliv = *Vireo olivaceus*, Xenoruti = *Xenops rutilans*.